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TRANSACTIONS

OF THE

Indiana Horticultural Society

FOR THE YEAR 1936

Being a Report of the Seventy-sixth Annual Meeting Held in Lafayette, January 12, 13, and 14, 1937, Together with Lectures, Discussions, Proceedings of the State Board of Horticulture and Other Papers of Horticultural Interest.

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Edited by
EVERETT WRIGHT, Sec'y-Treas.
Lafayette, Indiana

TO THE GOVERNOR

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REPORT OF THE INDIANA HORTICULTURAL SOCIETY

THE STATE OF INDIANA,

EXECUTIVE DEPARTMENT,

April 30, 1937.

Received by the Governor, examined and referred to the Auditor of State for verification of the financial statement.

M. CLIFFORD TOWNSEND,
Governor.

OFFICE OF THE AUDITOR OF STATE,

Indianapolis, Indiana, April 30, 1937.

The within report, so far as the same relates to moneys drawn from the State Treasury, has been examined and found correct.

LAURENCE F. SULLIVAN,
Auditor of State.

OFFICE OF THE GOVERNOR,

May 1, 1937.

Returned by the Auditor of State, with above certificate, and transmitted to the clerk of the Printing Board upon the order of the Board of Public Printing.

DICK HELLER,
Secretary to the Governor.

OFFICE OF THE BOARD OF PUBLIC PRINTING.

Received the within report and delivered to the printer May 12, 1937.

PARKE BEADLE,
Clerk Printing Board.

To His Excellency, Hon. M. Clifford Townsend, Governor of Indiana:

Sir: In accordance with the requirements of the law, I have the honor of submitting to you the Seventy-sixth Annual Report of the Proceedings of the Indiana Horticultural Society, together with other papers of horticultural interest.

Respectfully submitted,

EVERETT WRIGHT, Secretary-Treasurer.

OFFICERS OF THE SOCIETY AND COMMITTEES FOR 1937

Merle Troth, President.....Orleans, Indiana
Victor Judson, Vice-President.....Bristol, Indiana
Everett Wright, Secretary-Treasurer.....Lafayette, Indiana

Executive Committee

Laurenz Greene.....West Lafayette, Indiana, 1937
Lloyd H. Berger.....R. 2, Peru, Indiana, 1938
E. V. Hawkins.....Mitchell, Indiana, 1939

Legislative Committee

Frank Plass.....Vincennes, Indiana, 1937
Hon. Howard V. Johnson.....Mooresville, Indiana, 1938
B. L. Billingsley.....Greenwood, Indiana, 1939

Member of Advisory Board, Purdue University Agricultural Experiment Station

William M. Walton.....LaPorte, Indiana

Special Soil Conservation Committee

Earl Byers, Chairman R. A. Simpson Merle Troth

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CONSTITUTION AND BY-LAWS

OF THE

Indiana Horticultural Society

Constitution

Article I. The name of this organization shall be the Indiana Horticultural Society.

Article II. The object of the Society shall be the promotion of the horticultural interests of the State of Indiana.

Article III. The membership shall consist of annual members, who shall pay a fee of one dollar ($1.00), payable annually in advance on July first of each year; honorary members, who may be elected for distinguished service in horticultural pursuits; life members, consisting of all individuals who have been contributing members for twenty-five consecutive years.

Article IV. All horticultural, floriculture and pomological societies, vegetable growers, nurserymen's associations and kindred organizations whose annual dues are one dollar ($1.00) or more, when duly organized and incorporated, and local horticultural societies shall be eligible to affiliation with this Society when ten or more members of such organizations are contributing members of the state society, upon the payment of membership dues of one dollar ($1.00) per year.

Article V. The officers of the Society shall consist of a President, Vice-President, and an Executive Committee of three, which shall be the governing body of the Society and shall constitute the State Board of Horticulture.

Article VI. All officers shall be elected by ballot at the regular annual meeting and shall serve until their successors have been elected and qualified. But one member of the Executive Committee shall be elected each year to serve a term of three years.

Article VII. Secretary-Treasurers shall be appointed by the State Board of Horticulture.

Article VIII. Each member shall be entitled to a copy of all publications issued by the Society, and each affiliated organization shall be entitled to five copies, in addition to those furnished contributing members.

Article IX. The Seal of the Society shall consist of an outer rim embracing the inscription: "Indiana Horticultural Society." Within this, and above the central figure, consisting of a vase of flowers, a pear and an apple resting upon a section of vine with its fruit, the words "Organized 1860"; below, "Incorporated 1875."

Article X. This constitution may be amended at any regular annual meeting by filing a copy of the proposed amendment or amendments with the Secretary at the first session of said meeting. All such amendments

must be read to the Society, by the President or Secretary, at the first session. When thus duly filed and published, they may be taken up on the second or succeeding days for final action. A two-thirds majority vote of the members present will be required to amend.

By-Laws

I. The President shall preside at all meetings of the Society; the President or any two members of the Executive Committee shall have power to call meetings of the Executive Committee. The President shall present to the Society in his annual address such suggestions and recommendations as may seem appropriate, and shall appoint all regular and special committees except Legislative Committee as hereinafter provided.

II. The Secretary-Treasurer shall be a member of the Board of Horticulture ex officio; he shall record the proceedings of the Society, collate and prepare all communications addressed to the Society; establish and maintain correspondence with all local, county, district and state horticultural societies, and secure by exchange their publications as far as possible; aid the President in the dispatch of business relating to the meetings of the Society; prepare and publish circulars and notices of horticultural meetings of general interest, and report to the annual meeting of the Society an abstract of the matter which has come into his possession, and which with its approval shall become part of the transactions of the Society for the current year.

He shall act as Librarian of the Society, having the care and custody of its room and property under such regulations as may be adopted for the government thereof.

III. The Secretary-Treasurer shall receive and hold the funds of the Society, deposit all moneys in a bank to be designated by the Executive Committee, paying out the same as prescribed by the Constitution. He shall give bond to the Society in a sum to be prescribed by the Executive Committee for the faithful performance of his duties.

IV. The President and Executive Committee may call special meetings of the Society at such times and places as they may consider advisable; notice of such special meetings to be sent by mail to the members fifteen (15) days prior to the time of holding such meeting.

V. The annual meeting of the Society shall be held between September first and February first of each year, at the place designated at the previous meeting of the Society. Semi-annual meetings may be held as provided for in the preceding section relating to special meetings, the date for the holding of such semi-annual meetings to be left with the Board of Horticulture.

VI. Three members of the Board of Horticulture shall constitute a quorum for the transaction of business. The Board shall meet immediately upon the adjournment of the annual meeting of the Society, and afterwards at such times as it may designate. The duty of the Board of Horticulture shall be to carry on the business of the Society, to collect horticultural information for the obtaining of which it may employ an agent or agents to visit different sections of this or adjoin-

ing states, and may draw on the treasury of the Horticultural Society for money to defray necessary expenses only when there shall be money in the treasury available for such purposes. The Board shall make full and complete report of its proceedings at the regular meeting of the Horticultural Society.

VII. These By-Laws may be changed and amended at any regular meeting of the Society by a majority vote of the members present and voting.

VIII. A Legislative Committee shall be elected by the Society at its annual meeting, to consist of three (3) members, one of whom shall be elected annually to serve for a period of three years.

IX. Members whose dues become more than a year in arrears shall be dropped from membership in the Society and they shall be properly notified by the Secretary of such action.

PEACH PROGRAM

Although the program for the Indiana Horticultural Society was not scheduled to begin officially until noon, the Peach Day program began as a part of the varied program of the Purdue Agricultural Conference with Professor Monroe McCown presiding, and with a good representation of the peach growers of the state in attendance.

PROFESSOR McCOWN: I'm glad to see this many growers here to begin the meeting. We have a lot of problems to consider in our peach production program for Indiana. However, without further comment at the present time, I am going to call on Mr. Yates of Knox County to discuss winter injury to peaches.

WINTER INJURY TO PEACHES—VARIETAL CHARACTERISTICS AND OTHER FACTORS AFFECTING THE SEVERITY

By Wilbur Yates, Oaktown

When Chief Greene asked me to talk to you about winter injury of peaches, the thought came to my mind that the present time would be rather appropriate to discuss the effects of the very severe weather we had in Indiana just a year ago. In the light of what we now know, we may have been, figuratively speaking, conducting the watch over the dead at our meeting in Indianapolis last winter, and are just now getting around to conducting a suitable funeral service for a three-fourths dead Indiana industry. Since Mr. Byers and Mr. Waid are to take a part in the services, I suppose that I, as the first speaker, should logically be expected to read the obituary, leaving Mr. Byers to preach the sermon and offer suitable words of condolence for the surviving members of the peach family, relatives and friends. In this case Mr. Waid might render the benediction and express hope for the future.

However much we may want to pass over this serious situation lightly, the effects are still with us. I have heard many estimates as to the amount of winter killing in the middle west and it might be well

enough to review the situation in a general way, and outline a few causes of the damage and how it affected various regions and varieties. During the past summer I had occasion to cover quite a few of the principal producing orchards in Indiana, Ohio, Kentucky, and Illinois, which, along with some rather extensive correspondence, might throw some light on just where we ended up.

Last May I was in northern and central Ohio, and noted moderate to severe winter killing. The most serious results were in central and south central Ohio, with varying amounts of winter kill as well as winter injury in the northern lake and lake-shore regions. I might stop here and explain what I mean when I speak of winter injury and winter kill as these terms are particularly noteworthy when discussing this subject. In this discussion then, let us consider winter kill as meaning freezing sufficient to kill the tree outright as compared to winter injury which, though not killing the tree immediately, may seriously or slightly impair its producing capacity and, of course, ultimately terminate its life span.

Getting back to the northern Ohio region, when I was there in May there wasn't much winter kill apparent, but winter injury in varying degrees was everywhere noticeable. A lot of this winter injury has since showed up as more severe and many trees have died. After careful study of varieties in this section and after talking to many growers, I concluded that, generally speaking, the plantings on higher soils and the better cared for orchards fared best and that, on the whole, yellow varieties stood the cold better than white varieties.

My observations in Ohio were borne out in other sections with different degrees of injury, and, of course, a different set of conditions always surrounded each case of severe injury. I think it would be well to list some of the more common causes of severe winter injury and discuss briefly some possible remedies. Without question, last winter's damage was in direct proportion to two factors: first, the severity of cold, and second, the amount of vigor in the trees. Of course we all recognize the futility of trying to regulate the temperature when it reaches the extreme low readings experienced last winter. My experience has indicated that it is almost as futile, or at least as impractical, to try that with the milder temperatures of early spring.

Then what can we do about this second cause or contributing factor known as tree vigor? I would suggest the following points:

1. Use regular and liberal amounts of fertilizer.
2. Thin heavily.
3. Cultivate.
4. Select vigorous, hardy varieties.

In other words, keep your peach trees in excellent condition at all times and your chances for damage are much reduced. This rule, incidentally, provides a number of other benefits which are very evident.

Recently I heard a prominent grower, whose orchard had fared better than the average, make the statement that the better cared for orchards came through with little damage while the poorer orchards were mostly killed. I resented this statement at first, but when I analyzed

it in an impersonal way, I could see the wisdom of the statement. Some of you growers may feel as I did, and for this reason I am going to give you some of my observations covering a variety of reasons why certain orchards were low enough in vigor to be killed or seriously winter injured.

1. Trees that bore heavily in 1935 were, of course, more or less devitalized; this was agitated by dry weather in 1934 and a resultant heavy bud set for 1935 in many cases. This condition was even worse where thinning was inadequate.

2. Some sand orchards had a sufficient moisture deficiency in July and August of 1935, along with a normal crop, to produce results comparable to the first group.

3. Many orchards that were not given the best of care and had made only fair growth did not bear heavily in 1935 and, in numerous cases, escaped severe injury. These were minority cases, however.

4. Orchards on clay soil generally withstood the cold better than orchards on sand. The reason for this, when analyzed, usually reverts back to one of the foregoing reasons with soil as a contributing factor.

5. Certain orchards showed more severe injury where early fall and winter pruning had been done as against pruning in late spring.

6. Certain varieties, being able to withstand an adversity of conditions more readily than others, came through with apparently good winter hardiness, while under ideal conditions for vigor in all varieties, this advantage was reduced and was frequently negligible.

7. Trees planted prior to the 1930 freeze were much more susceptible in 1936 than those planted since that time.

8. Trees with low heads well covered with mounded soil came through the winter in excellent shape, and orchards of considerable age where this practice had been consistently followed were among the best survivors.

I suppose that it would be impossible, or at least impractical, for me to attempt a classification of varieties as to winter hardiness. One outstanding conclusion, however, is that with all the newly developed varieties for which so much is claimed, there is still none to surpass the Elberta as an all-around commercial variety. I may qualify this by including as an Elberta the Shippers Late Red, which I consider an improved Elberta strain. There is another very new variety—Don Byers' Hardie—which has all the attributes of an excellent winter hardy peach but, of course, it is still too new to be extensively recommended for commercial plantings.

Among other hardy to moderately hardy varieties I would class Krummel as being the most hardy but of questionable commercial importance. Gage Elberta, Golden Jubilee, Slappey, Salberta, Red Bird, Captain Ede, Bracket, Champion, Hiley, Georgia Belle, Hale Haven, J. H. Hale, South Haven and Heath Cling are other commercial varieties which showed winter hardiness somewhat in the order named.

In 1917-18 we found out a lot of things we didn't know before about winter injury. At least we were taken through the grammar school, so to speak, while in 1936 we must have taken the major part

of our high school training in the course. We, of course, all hope that it will be some time before we have to take a college course in peach tree injury. Personally, I don't ever want a short course, but just in case we may be forced to take it, let's remember our lessons from 1936.

PROFESSOR McCOWN: Mr. Yates, we appreciate that information. Mr. Yates has suggested that we hold the discussion until we have heard all three of the talks this morning.

(Professor McCown read what he termed the "Missouri Prayer" which related to a remedy for fruit growing under trying conditions.)

PROFESSOR McCOWN: I am going to ask Mr. Byers to see if he can give us the answer to that prayer.

MR. BYERS: I am going to try to take up a little different angle of the peach than that which Wilbur has given you. I'll try to more or less rattle over a few points about varieties and we'll have a discussion later. What I'll have to say will not agree in general with the "Missouri Prayer."

THE SELECTION OF COMMERCIAL PEACH VARIETIES

By Earl Byers, Vincennes

The selection of varieties to plant in a commercial planting of peaches for market would involve, first of all, a study of the markets to be used as well as the transportation facilities. If the market for the fruit is either roadside or nearby city, the list of tried varieties might well include Carman, Red Bird Cling, Champion, Hiley, South Haven, Rochester, Early Elberta, Elberta, J. H. Hale, Heath, and Krummel. Certainly, if there is a place in commercial peach production in which to test out new varieties, it is the roadside market. To the above list might be added Oriole and Golden Jubilee from the New Jersey Experiment Station, Hale Haven, a cross between Hale and South Haven, Fertile Hale, a sport of Hale which shows some hardiness, and probably a few other newer varieties.

If the market is in cities more distant than three hundred miles and which would require more than one night to reach by truck, then only the firm-fleshed, tough-skinned peaches would be worth while for commercial planting. Elberta has topped this demand for forty years and is still a long distance ahead of any competitor for popularity. In the freestone peach group it has become the standard by which all other varieties are judged. By many peach growers, it is considered as the only variety worth planting. It is to the peach grower what the Ben Davis apple was to the apple grower a generation ago.

When deciding upon a peach variety to plant to fill a gap in the market, one immediately finds that the market quotations are all in terms of Elberta and the conclusion would be to play safe and plant all Elberta. The gap between Georgia and southern Illinois Elberta would appear to be a good market for Elberta. Also the gap between southern Illinois and Michigan Elberta is a good time to have Elberta to sell, as we in Indiana have seen in some former years. And that gap

during the last half of August is probably our best bet in commercial peaches yet, and will continue to be as long as Elberta predominates.

In selecting varieties to plant, the second thing we would consider is public demand. What does the public want? Styles change in automobiles, and the old models with high wheels, small tires, poor springs and black paint give way to the low streamlined, easy-riding cars finished in flashy colors.

Fads in foods bring about great changes in what people eat. The idea that one can lose weight on a grapefruit diet has had much to do with the rapidly growing popularity of this fruit. "An apple a day keeps the doctor away," and other well founded ideas of the health-giving properties of apples, does much toward keeping apples listed on the housewife's food requirements for the day. However, when she goes to the fruit store to make her purchases she may inquire for a cooking apple or an eating apple, and finally buy the reddest apple, regardless of variety. There are too many *varieties* of fruit for the public to know the differences in them. People, in general, remember only popular types and highly advertised varieties. Everybody knows Delicious. The Winesap apple has long been a favorite on account of color and keeping qualities. Turley and Stayman both have had to be introduced as of Winesap parentage.

In the orange trade, customers call for Floridas or Californias. When buying Floridas they expect to get a firm-fleshed, sweet orange with plenty of seeds and more or less rusty skin. Those characteristics are common to a large group of varieties which are similar in type. The russet orange is advertised as thin-skinned and *sweeter*, selling readily on that reputation. And after all, why should the public be made conscious of the fact that the russet is a defect and is caused by the orange rust mite and that the russeted orange comes off the same tree as the yellow orange? They may both be *pineapple* oranges, while not even tasting or appearing like a pineapple.

So probably in the selection of a peach variety, perhaps we need not think so much of variety as of type. We need an improved Elberta. An Elberta with higher color; an Elberta free from bitterness at the seed; an Elberta type which is more hardy. There has been much searching for such a peach but the field seems to be still open and the order is a large one.

During the past twenty-five years, only two or three peach varieties have made any encroachment upon the Elberta as the most popular yellow freestone.

J. H. Hale, introduced in 1912, was enthusiastically accepted by the growers and the buying public because of its large size, high color, very firm flesh, and long carrying qualities. In all these respects, it was far ahead of Elberta. It consistently brought 25 to 50 cents per bushel more than Elberta on No. 1 grade, besides producing a limited quantity of very fancy fruit ranging from a pound to twenty ounces and which commanded fancy prices. It has been truly a show peach and a wonderful advertisement in our section, but it is rapidly passing out of the picture on account of tree weakness. After producing a few crops of

the most wonderful peaches ever grown anywhere the Hale tree seems to be exhausted. It seems that the great effort expended in producing the world's largest peaches has been too much for the tree. With good care Hale will return more money per acre between the age of four to ten years than any peach we have grown. By the time it is sixteen to eighteen years of age, Elberta will have surpassed it in financial returns. (See table.)

Trees Set in 1920-1924	No. Trees	Per Cent Living 1937	Av. Bu. Per Tree			Av. Price Per Bu.			Return Per A. Per Yr.		
			3 Yrs. 28–31	6 Yrs. 31–36	9 Yrs. 28–36	3 Yrs.	6 Yrs.	9 Yrs.	3 Yrs.	6 Yrs.	9 Yrs.
South Haven....	899	0	1.6	2.1	1.72	$1.40	$1.23	$1.26	$173	$194	$162
Elberta.....	4,263	31	1.8	1.78	1.63	1.52	1.11	1.19	212	147	145
J. H. Hale.....	1,851	0	1.5	1.4	1.38	2.00	1.16	1.43	225	122	147

South Haven, introduced in 1918, and a variety which has met with considerable favor in Michigan, grows rapidly and bears early. It requires heavy thinning, blooms three to four days later than Elberta, and will stand more frost in bud and bloom than Elberta, but the buds kill just as readily in sub-zero temperature as Elberta or Hale. South Haven ripens two weeks ahead of Elberta, gets off ahead of the Elberta rush and during the six-year period, 1931-36, it returned 40 per cent more money per year than Elberta. This was largely due to its producing a crop in 1932 when Elberta failed.

As a result of winter injury in 1930 and again in 1936, Hale and South Haven in our section have mostly passed out, while probably 50 per cent of the Elbertas are living. It looks like Elberta is still Hobson's choice, and the best commercial peach variety at hand, at least for us.

PROFESSOR McCLINTOCK: Mr. Byers, do you have a few seedlings scattered through your orchard?

MR. BYERS: No.

PROFESSOR McCLINTOCK: Do any of the growers have any? I am interested in knowing how seedlings went through the winter as compared to budded varieties.

W. B. YATES: I am glad you brought that up because there is a point that I think should be mentioned. I don't know whether it is practical but I have thought it would be well to top-work peaches. I don't know whether it is a practice worth considering.

PROFESSOR McCLINTOCK: Here is the angle I want to bring up. That is true in this section too. We have been interested in checking up this situation as regards pits. If seedlings go through the winter better than the cultivated varieties, isn't due to their inherited hardiness entirely? If that is the case above ground it is also the case below ground. We know something about apples and what would happen if

we don't use good stocks. Isn't the same true with peaches? If it is, then we are going from bad to worse with peach pits at the present time. We have been checking up on sources of peach pits in connection with class work and I know the situation is getting worse. My contention is that we are not producing as good trees as we used to produce.

EARL BYERS: I am mighty glad to get that slant from the University. That is a little bit out of the realm of the orchard man's work.

S. W. HOLMES: What was your acreage?

EARL BYERS: Close to 80 acres, 7,013 trees.

PROFESSOR McCLINTOCK: Do you think Mr. Byers, there is enough interest to justify work along this line?

EARL BYERS: There certainly would be.

W. B. YATES: I am under the impression that the fellows who have really been in the peach business will stay in it.

PROFESSOR McCLINTOCK: What do you think Professor Burkholder?

PROFESSOR BURKHOLDER: I think it would be worth trying providing it can be done in a way and at an expense so that it would be a practical procedure for a commercial man to follow.

PROFESSOR McCLINTOCK: Do you think there is a possibility of doing some of that work at the Johnson Station?

PROFESSOR BURKHOLDER: I think there is.

EARL BYERS: There is another thing I want to say before I quit. These average productions look very low. It isn't uncommon to pick 6, 10, 12 or 15 bushels off a tree and when you get down to an average production of 1½ or 2 bushels per tree it looks mighty low but that includes the ground planted originally to those trees. To get an average we divide the production for the year by the number of trees originally planted on the ground, not the trees picked from.

PROFESSOR McCOWN: Thank you, Earl. We have one more discussion this morning. I was in the Cowing Orchard at Muncie this past summer and was very much interested in the fact that they had such a high percentage of trees alive. I am going to ask Mr. George Waid, who has charge of that orchard, to tell you about their system of low heading and mounding of peach trees to protect them against winter injury.

LOW HEADING OF NEW PEACH PLANTINGS

GEORGE L. WAID, Muncie

Because of our northern location, and inasmuch as we had been told that we were too far north for successful peach production, we decided that we should try a few things that we thought might be helpful in

protecting our trees. Of course there are plenty of orchards much farther north than ours but most of them have a favorable location near a large body of water or are favored in some other way.

First, we secured the smallest trees we could get from the nursery—just mere whips, and cut them back severely at the time they were set out. Later we went over them again and where there were enough young branches coming out for scaffold limbs within a very short distance above the original budding point, we cut them back again. We were after a good spreading top that would be uniform but probably our major object was to get the branches coming out as near the ground level as possible in order that the trees could be mounded for better winter protection.

The mounding to which I referred begins with the regular fall application of paradichlorobenzene for the peach tree borers. We add a covering of straw over the mounds, the straw being obtained at the local fairgrounds after the fair. We make the mounds a little deeper around the body of each tree and extend it on out nearly as far as the spread of the branches. The straw varies in depth from three to six inches and this treatment is usually sufficient to cover the bases of the main scaffold limbs. In case of rather severe freezing back, there is a considerable amount of space protected by the mound which will usually give rise to new buds and vigorous shoots which will soon form a new top. We think we can give much of the credit to this method for at least two or three peach crops when the southern Indiana crop was a failure.

Our loss of trees after the extreme sub-zero temperatures of last winter was much less than the average over the state. We have trees of all ages from two years to 14 years of age and our total loss was between 30 and 40 trees out of a thousand trees. Of course the low heading is also valuable in other ways—especially for dusting, picking, etc. We find that dusting is more satisfactory than spraying after the dormant and first spray because of the heavy foliage which our trees have and which is too heavy to permit a good coverage with spray; the dust penetrates it nicely though.

Our varieties include Big Red, Champion, Rochester, Hale, Carman, Belle of Georgia and a new seedling which developed in our own orchard by chance which we are calling Early Perfection. It ripens from the middle to the last of July and is a white meated fruit, almost a freestone, with lots of color, juice, and flavor somewhat like a Champion. It gives very good promise and we have about 80 trees ready to bear this year besides the parent tree. Our Big Red variety seems to be the hardiest tree and the strongest grower.

Mounding Costs

We use about 20 loads of strawy manure (mostly straw) for this mounding. We are able to obtain it at the fairgrounds at a cost of about $3.00 per load, including labor, or about $60.00 plus time for placing same about the trees—about $9.00, making a total of around $69.00. It's true that good straw might cost more per load but it should also go farther and cover more trees.

We have been following this procedure for about 14 years and we find that it is also a great help in keeping down weeds and, of course, is beneficial by adding humus to the soil. We work it out after the winter is over and disc it into the soil between the rows.

I think that is about all I have in mind to say about our planting and about our method of mounding and low heading. If there are any questions which I can answer for any of you, I'll be glad to try to do it.

QUESTION: How many trees do you have?

MR. WAID: About 1,000 trees total, at one time we had 1,200 trees.

QUESTION: Where did you get your trees?

MR. WAID: I am not advertising—we got them from Hobbs at Bridgeport.

QUESTION: At what height do you head?

MR. WAID: Some trees start out right at the ground.

QUESTION: Do you think the trees are liable to split in the crotch where low headed?

MR. WAID: We don't find very much of that except in Carman and Champion which will do that anyway.

JOHN WILLIAMS: How about your crotch borer?

MR. WAID: They have more chance to work but that is a thing we have to contend with. We haven't been able so far to control that borer in that way. We have tried different methods but have not been very successful. Of course, with low headed trees we have been able to kill them with P.D.B.

PROFESSOR BURKHOLDER: Do you attempt to bring that mound of dirt and manure completely over the crotch wherever possible?

MR. WAID: Wherever possible the straw or manure is brought over the crotch during the winter. Before spraying we try to take it away.

PROFESSOR McCOWN: When do you apply your dormant spray?

MR. WAID: In March, we use nothing but lime sulfur for dormant spray and have kept entirely away from leaf curl. As to body borers and root borers, we have kept free from those too.

JOHN WILLIAMS: Do you keep up the P.D.B treatment each year?

MR. WAID: Not every year but we do every other year and sometimes each year.

EARL BYERS: I would like to ask if the trees you lost were all high headed?

MR. WAID: No, I wouldn't say so entirely. I would have to check on that before I could answer definitely. Some of them were Hale that we lost.

PROFESSOR BURKHOLDER: Have you some higher headed trees living?

MR. WAID: In 1930 we lost half of the higher headed trees.

S. W. HOLMES: What varieties have you in this orchard?

MR. WAID: We have the Shipper's Late Red, which is our pet (it is the hardiest tree we have), Champion, Big Red, Rochester, we still have some low headed trees of Hale alive, Carman, Belle of Georgia, and a new seedling developed in our orchard by chance which is known as Early Perfection. We feel like there is an opportunity for this on our market. As to whether it would be a worth while variety for commercial use in southern Indiana, I don't know—it is pretty juicy for shipment. It is a white peach with very beautiful color.

QUESTION: What nursery handles this?

MR. WAID: Hobbs, they are making quite a planting of it this spring. It seems to be hardy in bud; we had a partial crop when we had no others. I question if it is as hardy as Big Red.

PROFESSOR McCOWN: Mr. Scott, will you tell us what varieties you have?

MR. SCOTT: I didn't come down to make any speech. I don't have quite as many varieties but I do have a couple of rows in my planting of Big Red. While I have a heavy soil I found I had about as large a percentage of the Big Red winter killed. I have a few Champion but had very small loss on that. I lost about 25 trees last year out of about 550 trees in the orchard.

JOHN WILLIAMS: How is your elevation in comparison to Mr. Waid's?

MR. SCOTT: Considerably higher.

PRESIDENT COFFING: Do you mound your trees?

MR. SCOTT: No, I usually do that for peach tree borer treatment.

PRESIDENT COFFING: Do you grow as low headed trees as Mr. Waid?

MR. SCOTT: No, I like them a little higher.

EARL BYERS: I would like to ask how much straw you had on the ground?

MR. WAID: We had just enough covering of straw to give protection.

PROFESSOR McCOWN: Was there much loss in the Martin Davis orchard?

MR. WAID: I think Martin Davis had something like one-fourth loss in trees not headed higher than yours, Mr. Scott.

QUESTION: Wasn't it a fact that the southern part of the state had lower temperatures?

MR. WAID: We had no official check but it was 23 or 24 below zero.

PROFESSOR McCOWN: I want to call "Bill" Yates back again for just a few words because he has started an orchard this summer by this system of low heading.

W. B. YATES: We followed the practice similar to Mr. Waid's theory of using young trees. We used June budded trees. We selected our bud stock from our own orchard and sent it down to Alabama and selected root stock from mountain seedlings that were supposed to be small pits. We got a pretty uniform bunch of June budded trees. We headed the trees just as low as possible with the assurance of having as many as three or four buds left above the point of union. When we got the trees we graded them. We set the smallest whips to themselves and the trees that had branched quite a bit to themselves. I think if you could see the orchard now you would see, from the standpoint of low heading, that the smaller trees are of better shape. My theory is to keep the crown of the tree covered each winter. I intend to mound each tree enough to completely protect the head with soil.

PROFESSOR McCOWN: Mr. Hawkins do you have any suggestions to make relative to mounding or varieties to be considered for new planting?

E. V. HAWKINS: As I see it, it is a theory proposition with me. We have a block of about 250 trees and in that block we have four seedlings. We treated the four seedlings the same as the other trees and three of the four have gone out. One seedling we pulled out this fall.

We have Williams' Favorite, a yellow cling ripening late in the fall; one produced by ourselves, the Hobb-Haw. I would say that the Williams' Favorite came through the best, the Hob-Haw second, Elberta third.

PROFESSOR McCOWN: Mr. Williams, what do you think about the peach variety situation? You are located in LaPorte County and had a crop of peaches this year that many Indiana growers would liked to have had. What do you think of Elberta?

MR. WILLIAMS: Our Elberta came through better last winter than any other. South Haven killed pretty badly. I had nine crops of South Haven in eleven years, lost 1930 and 1933.

QUESTION: Is the Hale Haven as large in size as the J. H. Hale?

ANSWER: The Hale Haven will average in size along with South Haven from what I have seen of it. It is moderately small.

ANNUAL MEETING INDIANA HORTICULTURAL SOCIETY

Tuesday Afternoon

PRESIDENT COFFING: I just wonder how many in the audience remember the difference in the weather at the opening of our meeting today and the Annual Meeting a year ago at the Fair Grounds in Indianapolis. The weather looks good at this time and the attendance bids well for a good meeting.

PRESIDENT'S ADDRESS

HOMER COFFING, Silverwood

Members of the Indiana Horticultural Society, ladies and gentlemen:

We are today at the seventy-sixth milestone of this Society. We have come together, with out common interests, for discussion and solution of our problems, eager to learn for the *future* development of our *interests.*

Surely, there can be no truer type of man than he who endeavors to make the world better, by his having lived in it; and, by helping his fellowmen and planning for the welfare of future generations, though his walk in life be the humble one of pruning the vine and the tree, yet these examples of life and deeds will bring honor to his memory.

I have been a member of this society for twenty-five years, and it is interesting to note the changes that have taken place in that length of time. I want to mention some of the things pertaining to the past, present, and future of horticultural interests as I see them.

An orchardist must, of necessity, be not only a "jack of all trades," but a "jack of many sciences," for his activities must cover a wide range of subjects and he must be *skilled* along many lines.

Spraying

Twenty-five years ago at a meeting of the Society, we were discussing the number of times we should spray our apple orchards, and it was suggested by one of our leading members that we spray *once* before the bloom opened and *once* after the petals had fallen, perhaps using a barrel pump and two extensions of hose, which required vigorous pumping by hand to develop seventy-five pounds of pressure. At that time the sprays were applied more strictly by calendar dates while today *conditions* determine the time. The thermometer is as essential to an orchard man as it is to a doctor. He watches it in the spring to determine the time for the first codling moth spray, for he knows that the first eggs are laid only after the temperature has reached 60 degrees at eight o'clock in the evening. Counting from this time, allowing sufficient time for the eggs to hatch, he knows just when the first spray should be on his trees. His thermometer tells him when it is no longer safe to use lime sulphur. He consults his hygrometer, an instrument for registering relative humidity, to determine when to use and when not to use Bordeaux. We could rightly call the orchard man a meteorologist, for this is what Uncle Sam calls his weather observers.

Six to eight sprays applied over a short period of time at 400 to 600 pounds of pressure are necessary to grow quality fruit; therefore, it is necessary to use either a high-powered, large capacity portable or stationary outfit. Some growers have been able to lower the cost of production by the use of stationary sprayers. Thus, to be a good orchard man, he must be a mechanic as well, because sprayers, pumps, tractors and gasoline engines all have a habit of getting out of order. He must be something of an electrician, too, especially if electric power is used to pump spray water. There are also times when he has to be a plumber. In common with all farmers, he is a veterinary and a blacksmith. Perhaps few orchardists think of themselves as pathologists, but that is what they are, for every tree that grows is subject to disease. Every orchard man is a doctor to his trees, for, whenever a tree gets sick, it is his business to find out first of all what is the matter with it.

Our State University is giving us information now, with little effort on our part, about timely spraying to control the two major troubles—the scab and the codling moth. But, to be an orchardist and not know something about bugs and other insects would be like a preacher not knowing his Bible. To know the complete life history and control of the codling moth and the curculio alone should be sufficient grounds on which to award any fruit grower his diploma in entomology.

During the past years many advancements have been made in spray materials. All the spray materials are chemical compounds and every batch of "dope" the grower mixes in the spray tank is a chemical solution. His orchard is his laboratory. He has to know his materials, too, for to mix wrong things together would mean disaster. When he gets black sludge in the bottom of the tank he knows he has a precipitate which has resulted from a wrong combination. He is familiar with the chemical effect of certain sprays on foliage and fruit when applied under certain conditions of temperature and moisture. This he calls "spray burn." To know what arsenical residue and lead tolerance means is to know something of chemistry. The orchardist also knows something of the chemistry of his soil, for not to know this would be to apply his fertilizer without reason.

Twenty-five years ago approximately 75 per cent of our orchards were clean cultivated during the early summer followed by a winter cover crop; today probably 50 per cent of the orchards are under sod mulch. A little knowledge of botany comes in handy in order that the grower may know how plant food elements in the soils are absorbed by the root hairs of his trees; how these food elements are carried by the sap up through the trunk and limbs of his trees by capillary tubes, and how the leaves of his trees receive these elements much as a factory or mill receives its raw materials. He knows how this material is used by the leaves in the manufacture of starch and complex plant foods which his trees use for growth and in the making of his apples. To know that this manufacturing process goes on in the leaves, only in the presence of sunshine, and that the leaves have breathing pores, helps to make him, not only a better orchardist, but a broader minded man as well. He should also know something about bookkeeping since

there are numerous accounts to keep. If a man grows apples for a living he must sell them at a profit; consequently, it is necessary for him to be a good salesman.

Marketing

Twenty-five years ago our apples were packed in barrels, consigned to our favorite broker, and shipped to market by rail. Today I do not know of a single grower in Indiana using barrels, but, instead, all are using baskets and boxes; also, we can get our prices by radio market reports and can deliver to these same markets on the same day by truck, which, I am sure, you all agree is much more satisfactory. Much has been said about importing lower grades of apples by truck into our state from other states, thus glutting the market on lower grades and reducing the price on the better grades, but, so far, this has not been controlled. Each and every grower should make an effort to supply the demand as near to his orchard as possible, as this will give the grower and the consumer the advantage of smaller transportation costs. Oftentimes the grower is tempted to ship to larger markets on the market quotations but, if he has a good demand at home, this will give him the best final returns.

There never was a brighter prospect for the Indiana fruit grower than there is today. I doubt if we realize the advantages that we have here in Indiana, such as the center of population, weather conditions, roads, soils, and many other things. However, when I was in the railroad station at Indianapolis recently, I was unable to buy an Indiana apple, while there were plenty of Washington apples for sale. Can you imagine our reactions if we were traveling and found only Indiana apples for sale in the railroad stations, State Houses, or other public places in Portland, Seattle, or any large city in the West?

After twenty-five years of experience, I want to stress the choosing of varieties in planting orchards. I believe many of us are learning too late, the real importance of varieties.

Cold Storage

Since rural districts are becoming electrified, cold storages at the orchards are becoming more popular, and the grower has gained many advantages.

The 1936 Fruit Grower

We wonder if there has ever been a year more trying than 1936. Our winter meeting, held at the Fair Grounds at Indianapolis last January, was the beginning of unusual things in store for us. When I think of the temperature dropping below zero, accompanied by the snowstorm, I feel proud to belong to an organization whose members can take a blow so gracefully as our peach growers took the news that the prospective crop was being harvested while yet in the dormant stage. Our meeting was continued in the evening at the Hotel Lincoln where we had a grand time in spite of the weather, for rain, frost, sleet, snow and many other weather conditions give concern to the orchardist. Every day in the year, season in and season out, he keeps an eye on the weather.

Extremely low temperatures for days at a time cause winter killing. In the spring it is late frosts that worry him and all summer there is the possibility of hail. In August, when all is parched and dry, he watches the sky and prays for rain. What few scattered clouds he sees, he knows that they are only empties coming back from Iowa. Just about picking time, high winds come, and sometimes, almost over night, put his whole Jonathan crop on the ground; thus he learns to take it as it comes.

Due to the cold, many peach orchards were killed, also many apple trees were either killed or seriously damaged; furthermore there will continue to be damage showing up from winter injury for several years to come. Then there was a light apple bloom over the state, but in most sections the weather was favorable for pollenizing and a good set resulted. In June there was a heavy emergence of the seventeen-year locust and we are glad this event comes only once in seventeen years. Their damage was heavy, especially on young trees, and thousands of bushels of fruit were lost by the breaking of the small branches of the older trees. Another insect which I think is doing us more damage than we realize, by feeding on and hastening maturity of the foliage, causing the early dropping of fruit, and possibly causing the splitting of the Stayman, is the leaf hopper. But Professor McCown says if we will stay with him, we can control them.

Dry and extremely hot weather, which began in July, proved serious. Continued temperatures as high as 112 degrees caused many apples to sunburn on the tree and thus caused an early drop before maturity.

Indiana harvested about one-third of an apple crop which, naturally, brought much better prices.

Representatives of the Society met before the State Fair Board, asking that the state be divided into two sections, the line running east and west through the center of the state, thus giving the northern section a fairer chance to compete for prizes. This was granted and is reported as an improvement.

The American Pomological Society met at Cincinnati, Ohio, on June 15. Vice-president Merle Troth represented this Society, officially, and brought us an interesting report at the summer meeting of the Society, which was held at the Doud Orchards, nine miles north of Peru, on August 12, with a large crowd attending.

Many other things worthy of note are developing to help the fruit grower, and one I want to mention here is the prospect regarding the frozen food industry in its relation to the fruit grower.

Dr. Frank App, of New Jersey, at the American Vegetable Growers' Association meeting at Cleveland last year had this to say: "Quick freezing is the fourth milestone in the distribution of vegetables . . . Approximately one-third of our vegetables in the future will be processed in cans, one-third shipped fresh to market, and one-third quick-frozen. This last third will represent expansion in the vegetable industry instead of substitution, and will tend to stabilize the fresh vegetable market."

Fruit has the same opportunity as vegetables. Figures show that in 1935 the increase in consumption of frozen vegetables over that of 1934 was more than a hundred times. At least one city in the east, with

a population of less than 20,000 persons, has at present six stores in which frozen fruits and vegetables can be purchased. Five of these have been installed since last September, which indicates, conclusively, the increasing demand for such products.

Since about 1920, fruit freezing has been of considerable commercial importance, but, as is always true of a young industry, there are many problems concerning it yet to be solved.

Now I am wondering just what changes will take place in the next twenty-five years. Will we be doing our spraying from airplanes, will we be freezing our fruits and vegetables, and will our professors in horticulture be giving us varieties that will be one hundred per cent resistant to the wettest, driest, hottest, and coldest weather such as that which we have experienced during the year of 1936?

PRESIDENT COFFING: Merle Troth isn't here, is he? He is our Vice-President and since he isn't here I am going to ask the Secretary to act for a moment in his place. I think it is the usual customary practice to accept the President's Address as an assembled group; of course, there is a committee on it later.

Secretary Wright took the floor and a motion was made and carried that the address be accepted as read.

PRESIDENT COFFING: We are now ready for the Secretary's report.

SECRETARY'S REPORT

The summer meeting of 1935 was well attended by a very enthusiastic group of fruit growers. The Morgan County group cooperated in a very efficient manner and the meeting facilities were adequate at the Old Settler's Park in Mooresville.

The State Fair exhibits were good, considering the dry season, complaints were heard, however, from northern Indiana growers who felt that they had no chance on color and size in competitive exhibits against the growers from the southern portion of the state.

In January of 1936, President Coffing and the Secretary appeared before the State Fair Board, and there, together with a number of other persons representing various agricultural interests of the state, presented a number of facts favoring increased premiums which would allow a division of the state in at least some of the classes. The 1936 fair, as a result, showed a good group of exhibits in spite of a year which brought considerable damage in one way or another. Hail was largely responsible for keeping at least two of our biggest and most regular exhibitors out of the competition. It was very evident to those interested in the horticultural exhibits at the State Fair that the division of the state on the apple classes was an important one. At least 60 to 70 per cent of the exhibits came from the northern area including two or three of the sweepstakes awards.

Good local fruit shows were held during the fall months, notably at Muncie, Elkhart, Goshen, Lafayette, Aurora, and Evansville.

The Society continued its cooperation with the horticultural judg-

ing contests in connection with the Purdue Horticultural Show. A permanent type of medal, suitable for both fruit and vegetable judging winners, was selected; interest continued very good. The silver loving cup for apple sweepstakes again went to Mr. L. V. Doud of Miami county.

From October 1935 to June 1936, your Secretary divided full time duties between the Indiana Horticultural Society and Purdue Horticultural Extension duties during the temporary absence of Monroe McCown. This combination afforded further opportunities to contact more growers without incurring excessive travel expenses from the society treasury.

The annual Winter Meeting had a very successful beginning but the serious break in the weather cut severely into the attendance and general activities as well. A good session was held at the Lincoln hotel on the evening of the second day during which time we also covered the program originally scheduled for the third day. The exhibits were very good and the cooperative efforts of the equipment and supply company representatives was genuinely appreciated.

Hoosier Horticulture has continued to go out regularly each month. Members are urged to make requests for certain types of articles which they may desire at specific times. The continued good cooperation of the Purdue Horticultural and Entomological departments for articles in Hoosier Horticulture has helped much to keep the issues of interest.

Membership has continued only in a fair to average manner, the total reaching slightly more than 400 paid memberships. Some local groups have not been very active. Two or three of the larger ones in particular are carrying a large membership but very few memberships actually paid. The Secretary hopes to give some additional time to this matter very soon, working very definitely through the local secretaries of the active affiliated societies.

Several new memberships have been added, but with a small amount of help from some of the growers, we are sure another year should show a good increase.

The financial condition has improved somewhat from that of the previous year but the general curtailed program of a half-time secretary will probably continue indefinitely.

FINANCIAL REPORT—INDIANA HORTICULTURAL SOCIETY

In Account with the State

July 1, 1935—June 30, 1936

Warrants from Auditor of State..... $1,500.00*

Expenditures

	Vouchers		
Salaries:			
Everett Wright	298, 303	$125.00	
Everett Wright	314	125.00	
Everett Wright	320, 323, 325	80.00	
Everett Wright	332, 333, 337	80.00	
Everett Wright	342, 344	80.00	
Everett Wright	351	80.00	
Everett Wright	357, 367	80.00	
Everett Wright	377, 381, 383	80.00	
Everett Wright	385	80.00	
Everett Wright	394, 396	80.00	
Everett Wright	400, 405	80.00	
Everett Wright	407, 509	80.00	$1,050.00
Stenographer:			
Harriet Rost	302	$10.00	
Harriet Rost	313	10.00	
Harriet Rost	324	10.00	
Harriet Rost	336	10.00	
Harriet Rost	343	10.00	
Harriet Rost	350	10.00	
Harriet Rost	366	10.00	
Harriet Rost	382	10.00	
Harriet Rost	384	10.00	
Harriet Rost	395	15.00	
Harriet Rost	404	15.00	$120.00
Travel:			
Everett Wright	292	$15.39	
Everett Wright	293	15.75	
Everett Wright	297	20.30	
Robert A Simpson	299	10.40	
Everett Wright	300	6.36	
Everett Wright	301	30.69	
Everett Wright	308	7.85	
Everett Wright	310	11.22	
Everett Wright	311	4.48	
Everett Wright	312	6.21	
Everett Wright	315	16.83	
Everett Wright	321	12.96	

*May vouchers were mislaid after they were mailed from Secretary's Office. Paid from local Society fund. Expect reimbursement from Delinquency Appropriation Fund.
Vouchers 397, 400, 404, 405.....$102.53

Everett Wright	330	6.70	
Everett Wright	340	6.45	
Everett Wright	386	6.35	$177.94
Postage:			
R. M. Isherwood	291	$9.09	
R. M. Isherwood	304	6.11	
R. M. Isherwood	305	3.98	
R. M. Isherwood	319	6.58	
R. M. Isherwood	326	12.00	
R. M. Isherwood	329	6.75	
R. M. Isherwood	339	6.77	
R. M. Isherwood	341	10.00	
R. M. Isherwood	345	6.80	
R. M. Isherwood	353	6.89	
R. M. Isherwood	376	7.20	
R. M. Isherwood	387	7.22	
R. M. Isherwood	397	7.53	
R. M. Isherwood	408	3.23	$100.15
Telephone and Telegraph:			
Indiana Assoc. Tel. Corp.	296	$7.50	
Western Union Tel. Co.	306	.45	
Indiana Assoc. Tel. Corp.	327	3.75	
Indiana Assoc. Tel. Corp.	352	3.75	
Indiana Assoc. Tel. Corp.	374	2.00	
Indiana Assoc. Tel. Corp.	389	3.75	$21.20
Cuts:			
McNitts, Inc.	289	$2.95	
McNitts, Inc.	328	3.03	
McNitts, Inc.	338	2.95	
Circle Engraving Co.	375	6.23	$15.16
Office Supplies:			
J. H. Skinner, Director	317	$2.25	
Haywood Publishing Co.	318	3.50	
Haywood Publishing Co.	322	3.80	
J. C. Allen & Son	335	1.00	$10.55
Official Bond:			
Wabash Securities Corp.	290	$5.00	$5.00
Total			$1,500.00

FINANCIAL REPORT—INDIANA HORTICULTURAL SOCIETY

In Account with Secretary-Treasurer

July 1, 1935—June 30, 1936

Membership Deposits		$422.00	
Space Rentals from Annual Meeting		724.00	
			$1,146.00

Expenditures

	Vouchers	
Harry D. Simpson, Treas., National Apple Institute	294	$100.00
Everett Wright, Secretary, Signs for summer meeting	307	3.00
Everett Wright, Secretary, Entertainment for summer meeting	309	4.50
McNitts, Inc., Cut for Hoosier Hort	316	3.00
Indiana Assoc. Tel. Corp., Moving telephone.	331	1.25
Mack's Sign Shop, Oil cloth sign for Apple Show	334	5.00
Everett Wright, Travel, Michigan State Meeting	346	22.91
Everett Wright, Travel, Annual Meeting Plans, Indianapolis	347	6.59
Everett Wright, Travel, Illinois State Meeting	348	16.18
R. C. Eisenbach, Engraved cup, Purdue Hort. Show	349	10.20
Everett Wright, Travel, Annual Meeting plans, Indianapolis	354	6.41
R. M. Isherwood, Stamps for Annual Meeting	355	10.00
R. M. Isherwood, Postals for Annual Meeting	356	5.50
Indiana Vegetable Growers' Assoc., Banquet tickets for high school judging winners	358	3.00
Chas. W. Read, Booth Arrangements, curtains, etc., Annual Meeting	359	75.00
R. A. Simpson, Travel, State Board of Agriculture election	360	11.85
Everett Wright, Travel and expenses, week of Annual Meeting	361	30.52
R. A. Simpson, Annual Meeting expenses	362	10.00
Kane's Print Shop, Programs for Annual Meeting	363	14.60
St. Louis Button Co., Badges for Annual Meeting	364	26.65
Everett Wright, Sec'y, Incidental bills paid in cash, Annual Meeting	365	70.88
Dr. B. F. Driggers, Expenses and small honorarium, Annual Meeting	368	100.00
Glen Sowders, Annual Meeting expenses	369	4.75
Leslie Pierce, on Annual Meeting expenses	370	5.00

Frank Street, Annual Meeting expenses	371	10.00	
Indiana Board of Agriculture, for coal, firing, electric current, etc., Annual Meeting	372	152.40	
Chas. B. Dyer, Medals for Horticultural judging contests	373	4.25	
Haywood Publishing Co., Supplies	378	2.90	
Marietta Jacoby, Expenses and reporting, Annual Meeting	379	52.00	
American Pomological Society, membership	380	25.00	
Everett Wright, Prints and receipt books	388	1.25	
R. M. Isherwood, Postage	390	7.38	
Everett Wright, Travel	391	6.32	
R. M. Isherwood, Stamps	392	10.00	
Harriet Rost, Extra typing service	393	12.00	
Everett Wright, Extra help for proofing Annual Report	398	6.50	
Everett Wright, Travel	399	10.52	
R. M. Isherwood, Mailing Annual Report	401	30.00	
R. M. Isherwood, Mailing Annual Report	402	22.50	
Everett Wright, Travel	403	6.12	
R. M. Isherwood, Mailing June Hoosier Horticulture	406	7.45	
Harriet Rost, Services	410	15.00	
Charges on excess checks (August)		.24	
			$928.62
Balance—Receipts over Expenditures			$217.38
Balance—July 1, 1935		$219.97	
Plus June expense vouchers, check received in July		150.58	370.55
			$587.93
Less amount of May, 1936, vouchers (delinquent)			$102.53
Balance—July 1, 1936			$485.40

PRESIDENT COFFING: You have just heard the reading of the Secretary's report. What shall we do with it?

A motion was made and carried that the report of the Secretary be accepted as read.

PRESIDENT COFFING: It is in order that we appoint some committees at this time.

Nominating Committee:	S. W. Holmes
	Earl Byers
	V. V. Clark
President's Address:	R. A. Simpson
	E. V. Hawkins
Obituary Committee:	C. L. Burkholder
	Everett Wright

Resolutions Committee:	Merle Troth
	Frank Odell
	L. V. Doud
Auditing Committee:	Monroe McCown
	Meredith Reed

PRESIDENT COFFING: We have with us this afternoon a man who is very capable of talking to you not only on peaches but on any subject that would come up in horticulture. However, this afternoon we are going to have him talk about peaches and later we might use him on some of the other subjects with different kinds of fruit. We are asking him to come forward at this time. Dr. M. J. Dorsey of Illinois.

PEACH SITUATION IN THE MID-WEST

Dr. M. J. Dorsey

University of Illinois, Urbana

A severe winter such as that of 1929-30, or 1935-36 has been repeated a number of times in the past. Always the same questions come to the fore in reshaping things after whatever setback there comes from winter injury, or killing outright. In the mid-west at the present time the growers are concerned with questions of variety, cultural methods, hardiness, etc., in handling the peach industry as a whole, so we may very well first ask what change in varieties we should make in the new planting necessary in this section of the country as a result of the injury.

Varieties

Elberta has been the basis of our production in the past and we may very well raise the question at the outset as to whether or not we can depart from this variety in the new plantings. Experience has shown us just how the Elberta crop of the mid-west fits into the national situation. Any departure from this fundamental situation involves either a change in variety or a change in season. An earlier variety comes more directly into competition with the southern production, a later one with the northern production. A difficult variety, not known on the market, introduces a handicap coming from that fact alone. It takes time for the trade to get to know a variety. It takes time for growers to get experience with it, and to learn to know its strong points and weak points. So, in view of the fact that we have faced this same situation heretofore and that we have come out of it still growing Elberta, it would seem wise in this instance to stick by the old standby for the major part of our production. This seems to be especially true in view of the fact that much can be done in making it more attractive to the trade by better cultural methods. Some of the newer varieties like South Haven, or Hale Haven should, therefore, be looked upon not as replacing Elberta, but rather as supplementing it.

It is true that Elberta ranks only about midway in hardiness and in quality, and some of the newer varieties like South Haven have given us crops in some places when Elberta has been a failure. That fact alone has to be reckoned with in these regions where bud killing temperatures are more prevalent, but it would not seem wise, with some of the characteristics of South Haven, to build up big production back of it, especially since in tree hardiness it has been below Elberta during the past season. We may then note the general trends of some of the cultural methods with reference to greater temperature endurance of Elberta.

Experience shows that overproduction, defoliation, low vigor and immaturity of wood, all tend to lower the temperature endurances of the peach. There have been some clear cut instances in which greater injury followed overproduction, or we might say unregulated production, where excessive crops have been left on the tree; likewise, de-

foliation, particularly from leaf curl or the shot-hole fungus tends to reduce hardiness. On the other hand, trees in good vigor, with a moderately heavy type of pruning, in many orchards during the past season, seem to have had good temperature endurance. It is possible, however, to have temperature levels so low, especially when prolonged, that the physical endurance of the peach is surpassed. In this case the relatively slight difference which may result from variety or cultural treatment may not be enough to materially affect the general situation.

While we may readily admit that Elberta, like the Concord grape, ranks only about midway in the standard of quality, yet much can be done through good culture to raise the standard of quality as a whole, and at the same time increase the hardiness of the tree. It may be of interest to view briefly the general trends of some of the experiments we have carried on at the Illinois Station during the last eight or nine years, which have as their objective the tree conditioning of the crop. In this series of studies we have had in mind the fact that it is much easier to improve the quality of the crop which comes to the sorting table rather than to eliminate a large part of it because of poor size, after it gets there. Let us note briefly, then, the general trend of some of these results.

Pruning Experiments

One series of tests had as their objective the effectiveness of pruning in raising the general standard of the crop. It was found that while pruning was effective in holding the trees within bounds, and in regulating growth, particularly with reference to vigor and spacing, that without thinning, it was impossible to regulate the size of the fruit in this way. The vigor of growth thus induced tended to increase the set when the bud survival was heavy, and this in turn cut the size of the fruit accordingly. Pruning then had to be supplemented by thinning as a means of regulating fruit size, or conditioning the crop on the tree.

Nitrating

Likewise with nitrate applications it was found that in this series of tests heavily nitrated trees tended to set more fruit and that when the crop was not reduced by thinning or pruning the size of the fruit tended to be small because the numbers which had to be sized up were beyond the capacity of the trees. Several series of experiments were then run with thinning, pruning, and nitrating as variables to determine the place of each in the problem of regulating size when the set was sufficiently heavy to require it. A number of factors of the thinning, as such, may then well be reviewed at this point.

Thinning

One of the points which comes up naturally in using thinning to regulate size is the time when thinning needs to be done. It is generally recognized that on account of size the fruit makes a greater demand on the tree as the season advances. This would be true of weight alone to say nothing of a greater demand on the food supply as the season advances.

The three growth periods, first demonstrated in the peach at the New Jersey Experiment Station, were checked under Illinois conditions and in Elberta it was found that the first period of rapid growth extended up to about the time the stone began to harden at the tip. Then there was a period during midseason when the external dimensions of the peach changed relatively slowly, but during this same period there were important changes taking place in the hardening of the stone and in seed development. Following this period of 30 days or so, the last growth period, the so-called final swell takes place. This period ends at maturity. Our experiments in thinning indicate that in point of time thinning can be delayed until after the June drop, which is the last of the natural drops, even when the set is quite heavy. Where growth conditions are favorable it was found that relatively late thinning, that is during the early part of the second growth period could be made effective by paying less attention to spacing and more attention to the removal of the smaller fruits and crowded clusters.

Something of the relationship between pruning, nitrating and thinning can be seen from the data summarized in the accompanyig table. The upper limits of the set or crop can also be seen in this table. In the thinning experiments we have taken 2¼ inches as the lower limit of the major part of the crop, the load being adjusted accordingly. On account of the relation between size and yield we have found in some instances as few as 90 peaches in 50 pounds, and as many as 500 in the same number of pounds. It would seem then that there would be a point somewhere between these two extremes where we might reasonably arrive at a figure for the total load of fruit which might be left on the tree. We have arbitrarily placed this number at 1,000 to 1,200 fruits with a 22- to 25-foot planting distance for trees five years old or older. With this number of fruits per tree during favorable seasons the 2¼ inch size will be reached by all, or nearly all of the crop and the greater part of it during the unfavorable seasons will fall into this class. Since

PRUNING IN RELATION TO SIZE AND YIELD. THINNING JUNE 15-18.
Trees planted 25 by 25: 7 years old.
Three pounds $NaNO_3$ each spring.

Number Trees	Pruning	Average Number Fruits Thinned Off	Average Yield in Pounds of Different Sizes					
			1¾-Down	1¾-2	2-2¼	2¼-2½	2½-Up	Average Yield per Tree
11	None	733	5	82	196	38		321
3	None	0	32	213	98	5		343
11	Heavy	176	1	7	50	72	15	145
2	Heavy	0	1	19	81	80	15	196
11	Medium	631	1	31	123	102	12	268
3	Medium	0	15	99	173	23	1	310
11	Th. out	665	4	58	131	63	2	258
3	Th. out	0	27	183	180	2		393
5	Medium	Bloom	1	25	103	81	5	214

it is impossible to determine the season's growth conditions in advance it would seem advisable to set the stage for the unfavorable conditions through regulating the growth and total load by the combined influence of thinning, pruning, and nitrating.

In order to appreciate how difficult it is to size up a large crop it might be well to look at the growth tendencies of the peach during the last week of the final swell. It is during this period that the fruit is making the greatest demand upon the tree for both water and food supply, and it is during this time, also, that greatest reductions in yields occur when growth conditions are unfavorable. If we assume a planting distance of 25 feet each way which gives about 70 trees or so per acre, and a yield of 300 bushels per acre, a little over four bushels per tree, our measurements show that the crop increases from five to ten bushels per acre per day as maturity is approached, depending upon the growth conditions. There is always a tendency on account of price level, danger from bad weather, labor supply, sorting or packing limitations, etc., to start picking early. We know now that the quality of fruit picked too soon is low and that the yield of early picking is accordingly reduced. There is greater consumer resistance to fruit picked too green than to fruit picked nearer the end of the final swell when the ground color of the peach begins to assume a yellowish cast. The shipping distance then becomes a primary factor in determining the time of picking. The greatest quality is obtained when the fruit is picked tree-ripened which is possible only for local consumption. The grower will need to reckon with a number of things in getting the crop off to market. There is, of course, a fairly definite limit to which the ripening process can be allowed to go if the market is some distance away. It would be well, however, to study these variables year after year in order to get experience in putting a higher quality of fruit on the markets.

PROFESSOR McCOWN: There is a fruit grower here who has been following the practice of picking peaches tree-ripened. Mr. V. V. Clark, I would like to hear from you.

V. V. CLARK: I came down to listen and not to talk. This man knows his business. I am interested in the statement on the South Haven peach because South Haven and Hale Haven are in my planting. I picked some peaches tree-ripened, high in sugar content, took them into the cold storage, dropped the temperature down below 40 degrees and held them for a week. Then I took them out and put them along side of peaches picked the same day and they outsold them.

QUESTION: Isn't the success due to pickings?

DR. DORSEY: It lies partly in that. It is pretty difficult to get very many men to pick tree-ripened fruit. A part lies in successive picking. Some of the men in Georgia make a practice of going over the planting every day. Of course, the volume and quality become better but the firmness is poorer.

JOHN WILLIAMS: What would be the object of nitrating in alternate years? I know a grower in Michigan who follows that practice.

DR. DORSEY: I guess that could be done.

R. A. SIMPSON: Dr. Dorsey, how would you apply the nitrogen in the fall? Would you spread it under the trees or over the whole area as far as the tree is concerned?

DR. DORSEY: I think I would put it on under the spread of the branches.

PROFESSOR BURKHOLDER: I was going to reply to the question of picking. I believe the problem is solved when you get a good man as a picking boss. I believe a grower can afford to pay good money for a good high-class picking boss. Anyone can pack them if they come in right.

Wednesday Morning

PRESIDENT COFFING: Our first subject this morning deals with irrigation and our speaker is Professor Clarence Baker of Purdue. I think most of you know him. Professor Baker.

PROFESSOR BAKER: Mr. President and members of the Indiana Horticulture Society. I'm not going to do much of the talking on this subject as we have some men here who have had some good experience recently and I'm going to let them make my speech. First, I want to call on Mr. Frank Odell of Cannelton.

ODELL IRRIGATION REPORT

FRANK ODELL: They say we have a humid climate; and if you will look at the weather map you will see that down on the Ohio River, where I am located, we have had an average precipitation over the past 45 years of a little more than 50 inches. Through the growing season of six months, from the first of April to the last of September, we are presumed to average 23½ inches of rainfall. The heaviest year that I have kept record for this past 25-year period was 1915. In that growing season we had a total of 27½ inches. In other years it has run considerably below 20 inches. In 1930 it dropped to some 17 inches total. I thought that was the limit and we could never go below that, but this year between the first of April and the first good heavy rain on September 23 (nearly a 6-months interval) we had 3 inches of rain. By the middle of June our trees were in distress. By the the middle of July we were getting such severe injury we decided to install an irrigation plant.

I had 4,000 feet of pipe laid within eight days but we were held up on our centrifugal pump with a special type of impellor, 19¼ inch. We used a bronze impellor (instead of cast) so if it should pick up any gravel in pumping out of the river it would not break the pump, merely dent the bronze. We were supposed to get the pump out of stock in Cincinnati. After two weeks of delay I found they were shipping it from Beloit, Wisconsin, and after another week I found they were casting it and had had some trouble in the casting. Finally when we got the pump, which was the middle of August, about three-fourths of our crop

had already dropped off the trees so we couldn't expect a successful season from that time on. Nevertheless, the next week we applied a million gallons of water and the next week another million and then we were into our picking. The Winesaps, which had not already dropped, took a very fine size and high color, and came out of our drought injury excellently. While we had already lost 50 or 60 trees, we saved, I am sure, at least 500 trees, mostly Rome Beauty, from dying. That was the result we had this year.

For next year we have all the equipment on hand. We will put in a few more thousand feet of 2-inch laterals on four ridges in high points of the orchard. The total expense when we will have finished with the installation of the other laterals will be approximately $3,000. Mr. Dutton of the Ohio Orchard Company told me that his total expense in connection with his plant, which has been in use seven years, was about $4,000. Mr. Frame Brown had about $5,000 in his plant. Mr. Guy Beauman, in Illinois, said that his plant had run up to about $6,000.

The amount of water we can pump against a 300-foot head runs 135 gallons per minute, which is better than 8,000 gallons an hour. We usually start pumping about 4:00 in the morning and pump up until about 10:00 at night and sometimes if we are in desperate need of water we pump all night, putting an extra man on the pump and tractor, and in that way pump about 16 hours a day, putting on a million gallons a week. We have 90 acres in the higher orchard. What the expense for operation and maintenance will be will depend, of course, on the volume of water pumped, varying from $50 to $70 per million gallons.

QUESTION: What size pipe do you use?

FRANK ODELL: 2,000 feet of 4-inch pipe from the river to where we first enter the orchard and taper off to 3, 2½ and 2-inch along the end where we get out 4,000 feet from the river. The laterals are of 2-inch pipe. We use 1,050 feet of conductor and eyelet hose. The water under full pressure will squirt out of the eyelet opening as much as 10 or 12 feet or farther, 15 or 20 feet if you want to compress it. The eyelets are every two feet. It is a much better hose than the ordinary ooze hose and where the canvas ooze hose usually rots out in three or four weeks this is specially waterproofed to last two or three seasons. Various growers whom I have visited have used this method of application. This eyelet hose is, I think, very satisfactory for our purpose. Our ground is somewhat rolling but I doubt if the slope anywhere is more than perhaps eight per cent. The eyelet hose was supplemented on the steeper slopes by some contour plowing, one furrow or more to the row in the lespedeza or alsike clover sod which serves as a check as the water tends to run off the slopes down through the row. We had one man with a shovel watching those places all the time and he would make little dams to retain the water. We had practically no run-off. When we turned the water off at night the mud was over the tops of our shoes but by the next morning the water had all soaked in and you could walk over the surface again.

QUESTION: How much water does it take to a tree?

FRANK ODELL: It takes a lot, as much as 5,000 gallons to a large 20 or 25-year-old tree. This will soak the ground to a depth of 3½ feet, which is as deep as your roots penetrate anyway, and then it will not have to be renewed for a month or five weeks. I believe that fewer heavy applications are more economical and more effective than light sprinkling. Most of the evaporation you get is in the first day and a half and after that the loss is very little.

One thing that impressed me very vividly when I came to study the theory of irrigation was the experiments in California where they determined that where there was a cover crop of weed growth or grass it required 50 per cent more water to water the trees than where there was a clean cultivation or the cover closely clipped. I got a 7-foot mower with which I could reach in much farther under the trees; and immediately I eliminated two men who had been hand-scything under the trees. By keeping the grass and weed growth down very low where we were not discing the orchard, I felt that was making the water serve its purpose more effectively than in any other way.

Those are just a few of the highlights. We have the thing ready now and if we have another dry year next year we will start our pump and continue through light showers and up until we get a good rain. Then we can quit for a while and when it looks like it is getting dry again we can start once more.

This year we took a shrinkage in our crop of at least 10,000 bushels. In 1930, we lost half of our crop and had small fruit, inferior color, etc. In all of the past 25 years there has never been one single summer that we didn't have a dry period of two or three weeks that hurt the crop some. I will say in the past six years alone we have had an injury from drought of $25,000. Mr. Dutton of the Ohio Orchard Company said he wouldn't have an orchard today if he hadn't put in the irrigation line.

QUESTION: What is the size of the eyelet hose?

FRANK ODELL: 2-inch hose.

QUESTION: What does it cost?

FRANK ODELL: The conductor hose costs 16c and the eyelet 14c. The conductor is heavier but I was able to make a fortunate buy for next year from the Fire Department at Cannelton of a quality of hose that won't stand fire pressure but will make good conductor hose at a few cents per foot. At the advice of Mr. Dutton, who has had a number of years of experience with the hose, we made them cut down our 200-foot lengths to 150 feet and I have coupled as many as three and four of those hoses together. Where I couldn't reach an extreme end of the orchard any other way we coupled the entire 1,050 feet of hose together.

QUESTION: How many men were you using?

FRANK ODELL: One man at $1.50 and three boys at 75c per day.

QUESTION: How much more water does it take where the ground is bare than where you have straw?

FRANK ODELL: Where there is straw the water soaks in more readily—the ground isn't so hard on top. I should think about 50 per cent more water can be used before you get any run-off where the ground is mulched than where it is bare.

PROFESSOR BAKER: Thank you very much, Mr. Odell.

Mr. Coffing suggested that I call your attention to the fact that it requires about 27,000 gallons for an acre inch of water. I think the correct figure is 27,154 gallons.

Mr. Holmes of Mitchell, Indiana, is with us this morning. He has practiced irrigation for several years and has probably used more water than anybody in the state. We would like to have him speak to us at this time.

S. W. HOLMES: Frank Odell and I are mighty good friends. He has had one year of experience and knows all about it and I have had three and don't know anything.

In 1930, we had severe tree wilting. We ran three spray outfits night and day, using six teams and six men, putting about 300 gallons to the tree. We used a 3-inch metal spout. I might mention first that we are very fortunate in having city water to our farm. This water costs us about $130.00 for the first million gallons and it costs $100.00 for every million after that.

In 1934, we conceived the idea of putting this water over the orchard through pipes and we wanted the water under the trees where there would be less evaporation so we adopted the idea of distributing the water through hose. Our trees are 33 feet apart. We conducted the water through 2-inch pipe. Later we started out with 3-inch pipe so as to get better pressure. We found that in about 2,500 feet of pipe where we had 80 pounds' pressure we lost about 50 pounds of that pressure before we got to the extreme end of the pipe. We later used another type in another part of the orchard, 14 rows between and every four rows. Along here we attached a one-inch rubber hose, watering 56 trees with each hookup. As nearly as we could check, we got an average of 250 gallons to the tree at each application. We used six lengths of hose and six men night and day, 12-hour shifts, until the water company restricted us on the water on a few extremely hot days.

As Mr. Odell told you, we were much drier than you at Lafayette. Our last good rain was on the 12th of April. We had two pretty good showers during the summer but nothing like enough to supply the deficiency. We began to water the first of June and watered until the middle of September. We put on seven and a half million gallons of water. It cost us $1,000.00 and I figured the labor for the whole thing just right around $2,000.00, making the water cost us 40c a thousand gallons.

We watered an area under the tree on the average of about 25 feet in diameter. As you will figure, it is practically half of the area that

belongs to a tree on a square that is 33 feet each way. We thought by getting the water under the tree we would prevent evaporation.

We put on during the year, as I have said, seven and a half million gallons in three and a half months. You can figure 27,000 gallons to the acre applied on half of the area on half of our trees. We had 4,000 trees and were watering 2,000. We watered a block of Grimes which had practically all of our Grimes crop of 5,000 bushels and Jonathan which had very few apples. We watered only those trees that had a big crop. By watering at night the men couldn't always tell which trees had a crop and which didn't, so some of the trees were probably watered that shouldn't have been. We figured we watered about 2,000 trees and covered one-half of the area of each tree, which will figure 10 inches of water under individual trees. This year we didn't get enough help from above, but in ordinary seasons I think we would have very satisfactory results. I think the season would be very rare when it wouldn't pay to put on one or two applications of water. I think that is true any time when bluegrass is wilting in your front yard or in the pastures; I believe a good strong application of water to the orchard will do good. We found that the Grimes in the watered section matured earlier and we had some additional size. You can't take the place of nature but you can supplement it.

QUESTION: From the time you began to water, how long did it take to cover the 2,000 trees?

S. W. HOLMES: A week; we stayed 15 minutes on each tree.

FRANK ODELL: Mr. Holmes, don't you feel that by watering and also by thinning in connection with it, you can raise your yields from year to year?

S. W. HOLMES: I think that remains to be seen. Our experience has been that in these three years we have had no cracking of Stayman Winesap apples. I find that there were some growers who didn't water through dry seasons and they didn't have any cracked Stayman, and I find some that did have a very high percentage. It was our experience in '31 that probably 75 per cent of our Stayman apples cracked, so if we can prevent, by watering, the cracking of Stayman apples and maintain a good production average of quality fruit, it has amply paid us for many of the watering operations performed.

PROFESSOR BAKER: Is Mr. Sanford Fletcher here? I have some information regarding some work done in his orchard. Mr. Fletcher is located at Middletown, near Anderson. He ran some very interesting irrigation experiments in his Delicious orchard last year.

Here are two lots of apples, from irrigated and non-irrigated trees. You can see two things—difference in size and difference in color. The large apples have more red to start with but the cast is also an entirely different color. You will notice it is a much brighter red.

PRESIDENT COFFING: Is there any difference in the eating quality?

PROFESSOR BAKER: As you can imagine, there is. The large apples came from trees that had been watered once, twice, and three times. Mr. Fletcher made the practice of applying 1,000 gallons per tree at each application. The size is not directly proportional to the amount of water he applied. Fruit watered once showed a 28.4 per cent increase in size over the non-watered. Fruit watered twice showed a 70 per cent increase in size. Having a very friable soil, he was able to apply as much as 5,000 gallons per tree without any run-off.

Several other men have practiced irrigation but we will not have time for further discussion on this subject.

QUESTION: Do you know the date of the first watering?

PROFESSOR BAKER: It was quite late.

PRESIDENT COFFING: I am sure we have all enjoyed this discussion on irrigating the orchard, trying to protect ourselves against dry weather, but we are running a little behind schedule and will have to hurry on.

Our next speaker on the program this morning is going to talk on "Trends in Orchard Management." Orchard management is something we all need to know about regardless of the size of the orchard. It is one of the things that tells us whether we make any money. At this time Dr. Dorsey is going to talk to us on this subject. Dr. Dorsey.

TRENDS IN ORCHARD MANAGEMENT

DR. M. J. DORSEY

University of Illinois

In evaluating the trends in orchard management as we encounter them today we will discuss first those tendencies in the outside world which are more or less beyond our control, but which at the same time have a marked influence upon what is done, or not done, by the orchardist. These general considerations have been discussed before most horticultural meetings heretofore, and, consequently need only brief mention at this time.

At the outset we will first consider the relative favor with which the apple and peach are now regarded as compared to their former status. The apple, of all the fruits in America, has a long tradition back of it. "An apple a day keeps the doctor away," comes down to us almost as a legend from the time when we looked upon the apple as one of the most healthful of foods, primarily, we know now, because it was most readily available at the time. That situation has changed very materially within the last two or three decades and we find the apple gradually losing ground to the citrus fruits, while the peach is about holding its own. We need not go further than these two fruits, but it is significant to note that this fundamental change in the public attitude, or in the buyer's dollar vote, has taken place.

In the wake of this tendency we have also seen gradually coming to the fore with greater and greater emphasis upon a few commercial

varieties. This change has been so rapid that some growers are "caught" with plantings devoted, to a greater or lesser extent, to varieties going out of favor. This situation can, of course, only be met in the old trees by top-working, but can be reckoned with in the newer plantings by giving careful consideration to those varieties which are best adapted to the local situation, and in greatest favor in the trade. Even then further shifts in trade preference may be expected to play a further part in the process of elimination. In the wake of this trend there lingers, of course, in the memory of the public some of the older varieties now on the wane. This fact tends to soften the situation somewhat for those with the older variety list.

We now know that advertising has played an important part in this transitional period. The lack of advertising back of the apple and the presence of it in some of the other fruits, especially when in the latter the advertising is based on new food values and new uses, has been a big factor in determining the buyer's choice. The answer to this, of course, is for the apple grower to meet the situation with the same technique based on facts just as sound and vital.

We need not lay much stress upon the changes which have taken place in transportation, storage, packages, etc., because these are well known and most of us here have seen them happen. The long haul from the western valleys, the concentration points in storage in the big city centers, the truck movement, the standardized pack, are all a part of the same general trend and react upon us, primarily, in that we are compelled to fit into a broader and more impersonal background. As compared to the western production centers, however, growers in the mid-west have the advantage of being nearer to market, a fact which we are only now beginning to evaluate properly.

We might mention also as a part of this general picture the rise in public favor of the vegetable crops. This competition has taken the form not only of greater production, considering the country as a whole, but also in making the vegetable crops available in the market over longer periods as a result of the movement northward from the earlier centers in the south.

Still other items might be mentioned in this same list, but these will suffice to show that the apple grower has what might be called an outside situation to reckon with. These tendencies are impelling and have to be met whenever apples are offered to the trade.

We will now consider some of the trends in handling the orchard which have developed in the last few years. We are all familiar with the fact, of course, that the production program is becoming more expensive, and at the same time, more difficult or complex. The spray program is heavier, terminating in the washing problem. The variety situation is changing, making some orchards marginal, if not unprofitable. We now know when we take the long look at the soil problem that an orchard is a one-crop system and that the problem of keeping up soil fertility becomes more and more acute as the orchard becomes older. This will of necessity require that new thought be given to the planting plan on the one hand, and the ground problem, including fertilizers, cultivation and cover crops, on the other. With the production

problem becoming more complicated and more expensive, we have been forced to give consideration to the level of production. This has brought many of the detailed operations to the fore, such as pruning, fertilizing, cover crops, irrigation and thinning. We will now consider the relationship of these practices in some detail.

As a result of experience and research we are gradually developing a point of view regarding pruning. It takes the form of training in the early years of the orchard and a thinning out and growth directing process during the later years. We have made the mistake generally of looking upon pruning as a practice which could be done, or not done, as the case may be, and as a unified procedure with all tree conditions. On account of this, pruning has, in some instances, done more harm in the orchard than good. As the tree grows older the tendency is for the terminal growth to become less vigorous. This naturally concentrates the branches, giving a condition which may very well be described in terms of the corn field as 10 stalks per hill. Pruning, whether it be called detailed, small cuts well distributed, or slim wood pruning, could be used at the beginning of this tendency to correct it more effectively than after it has taken place to remedy it. Used in this way the bearing surface of the tree, as maturity is approached, can be kept thinned out, letting the light in, and at the same time keeping up the vigor of growth.

While our experience with the apple in the mid-west indicates that of the necessary growth elements, nitrogen is most often deficient; nevertheless we might very well begin to look here and there for evidences of deficiencies with some of the other elements. Up to the present time under our conditions, fortunately, these are apparently not as yet acute.

Considering soil erosion as well as soil depletion from continuous use of the land by an orchard we may have to give consideration to changing the planting plan. Why may we not try a planting system with an interplant in the middle of the square, the corners of which are marked by four permanent trees, leaving space enough between the trees to permit of normal growth and production in the interplant up to the time of reduced growth vigor somewhere near the 20- or 25-year period. If the temporary trees then are removed the next period with the permanent trees can be approached with more space for the growth of a cover crop, more available moisture, and more space to carry out the necessary operations in the cultural program, and at the same time permit the permanent trees to expand normally. With fewer trees per acre production can be kept up because they will be larger and more productive.

We may now consider two other items which we are just beginning to incorporate into our program. One is irrigation and the other is thinning. The primary purpose of irrigation is to regulate the size and quality of fruit as well as the total yield. It is rather difficult under our conditions with the extremes we have to encounter in both the presence and absence of soil moisture to project irrigation into our cultural system. It would seem that if we are to go to this expense that we will have to give further consideration to balancing the other practices such as pruning, nitrating, and thinning. Unfortunately, in some respects,

the combined influence of these practices tends to increase the set since the apple may bear one, two, three, or even four per cluster. An increase in the number per cluster or the tree as a whole, through increasing the total load may seriously reduce the size of the fruit when the crop is beyond a certain limit. The experiments in many places and under a variety of conditions show a fairly definite relationship between the size of the fruit and the number of leaves. As was emphasized with the peach this is only another means of arriving at the total load which should be left on the tree. The experiments in this direction, however, have not gone far enough as yet to determine whether, under our mid-west conditions, we can irrigate, fertilize, prune, and thin, and while producing a profitable crop one year develop sufficient fruit buds for a crop the next year. The off-year with some of our varieties becomes acute at a very early period and under some conditions becomes definitely established after the first three or four heavy crops. Sometimes this takes the form of limb alternation, sometimes tree or orchard alternation. It is in this field that we need more experience to guide us under mid-west conditions. It seems now as we look at the evidence available that we will have to go just as far as possible in regulating the crop through both thinning and pruning if we are to get the full advantage of irrigation, and at the same time, at least partially correct the biennial tendency as it appears in its early stages.

The term balance then comes to the fore as a very important word in the cultural program of the future. In directing the care of the orchard many things have to be considered in weeding out the weak points. In one instance it may be poor varieties, in another poor spraying or the wrong type of pruning for the tree condition to be dealt with. Weak trees, poor sites, erosion, overbearing, etc., all need to be surveyed as the season advances and the necessary adjustments made. In this way the alert grower can go a long way in eliminating the consequences of unregulated growth and bearing, which are expressed so definitely in the reduced size and ultimately in the off-year. Irrigation can be used as an effective tool in overcoming, at least in part, the effects of moisture deficiencies, but when this practice is added to the cultural program it becomes even more necessary to balance up the other items in the care of the orchard.

It will be seen, then, that at present the trend is definitely toward a more expensive and complicated program which will make it more and more necessary to balance up the different items related to production in order to raise the level of the yield from year to year to a point where the returns will justify the expense. The "outside" influences have had an impelling influence in this trend as we encounter it today.

MEREDITH REED: Have you any set rule for thinning apples?

DR. DORSEY: Not to the extent we have with peaches. I believe, however, Mr. Reed, we will have to fit thinning into the program early, a combination of thinning and pruning.

QUESTION: The suggestion is that there will be increased costs by following detailed pruning and thinning. How far can one go and make a profit?

DR. DORSEY: As I see it, the objective is to correct the off-year. Your profits are going to come largely in that direction. You are going to reduce the yield in the on-year. You may raise the price but you will reduce the yield and if you can get somewhere near a crop the next year there is your reward.

QUESTION: In trying to save expenses, how soon will one be saving by practicing winter pruning?

DR. DORSEY: I think you will be reaching your limits around the 15- to 18-year period. If the soil is light it will be sooner; if the growth conditions are good it will be later.

QUESTION: Suppose you adopt a program of heavy mulching instead of irrigation, what would you get?

DR. DORSEY: Never permit the soil to lay bare as it is likely to erode badly. I believe erosion will remove soil faster than it can be built up. I think that it is possible through mowing and discing to have some sort of a growth on the ground all the time. If the season happens to be extremely wet a growth will actually help dry out the upper layer of soil.

QUESTION: How close to the trunk of trees would you recommend mulching 18-year-old trees?

DR. DORSEY: Leave a space 3, 4, or 5 feet in diameter and give the poison ivy a chance. Our figures show that 85 per cent of the roots come under the spread of the branches.

PRESIDENT COFFING: I think we all agree that orchard management is a pretty big problem and we want to thank Dr. Dorsey for his talk along this line. I know we have all enjoyed it.

PROFESSOR BAKER: Mr. President, Professor Burkholder suggested, inasmuch as there were considerable unfinished discussions on irrigation and his subject fits right in, that we take a little more of his time for discussion on irrigation; however, I don't think we should encroach very much on his time.

Frank Farnsworth is with us and he has done a lot of this sort of thing in Ohio. Mr. Farnsworth, will you please tell us something of your experiences?

FRANK FARNSWORTH: I came over here to listen and not to speak. I've certainly enjoyed your meeting up to the present time, and also your hospitality.

Our irrigation set-up supplies water for 150 acres. Our source of supply is the Maumee river, which is at the foot of the orchards and about 45 feet below the orchard level. We have two alternating pump outfits, a 30 horsepower oil burning engine, direct geared to a 6″ centrifu-

gal pump, and a 20 horsepower oil engine direct geared to a 4 x 3 centrifugal pump. Either of these pumps discharge into a half mile of 8" pipe leading into another half mile of 6" pipe, which in turn leads into a half mile of 5⅝" pipe. Gate valves are used to close off one section, if it is necessary to make repairs or alterations on one of the sections.

We have 2" risers with swinging street ells on which there are removable 2" gate valves which control the flow of water into 400' lengths of 2" diameter canvas eyelet hose. The one and a half miles of main pipe passing through the center of the orchard, together with the 400' of eyelet hose on each side, supplies three-fourths of the 200 acres of orchard.

This installation was started in 1934 and the irrigation cost to date is about $8.00 per acre annually. This cost includes investment charges, operation maintenance, and application.

PRESIDENT COFFING: We certainly thank you, Mr. Farnsworth, for telling us of your experiences on irrigation, and we're glad to have you here at our meeting.

Professor Burkholder is now going to talk to us on mulches. I think he will tell us we don't need pipes if we will just put on plenty of mulch, and I believe that is the system I like the best. Professor Burkholder.

COST OF STRAW MULCH—PURDUE ORCHARD, BEDFORD, INDIANA, 1930-1936 INCLUSIVE

By

C. L. Burkholder

Purdue University Agricultural Experiment Station

The various advantages and disadvantages of different systems of soil management in the apple orchard are quite well known to Indiana fruit growers. However, any particular method which has conserved a maximum of rainfall during the winter months, as well as throughout the growing season, since 1929 deserves special consideration. The value of straw mulch in this respect has been quite clearly demonstrated during the recent drought years. Nevertheless, the average commercial grower has the feeling that a straw mulch collar for every tree in a large orchard is bound to be a very expensive item. From this stand-

VALUE OF A TON OF STRAW IN TERMS OF NITROGEN, PHOSPHORUS AND POTASH. 1937 VALUE

	Nitrogen* (Pounds)	Phosphoric* Acid (Pounds)	Potash* (Pounds)	Ton Value† (Dollars)
Wheat	10	3	15	1.67
Oats	12	4	30	2.74
Rye	9.3	5.3	16	1.82

*Henry's Feeds and Feeding.
†Nitrogen—6c, Phosphoric Acid—5½c, Potash—6c per pound based on cost of plant food in mixed fertilizers

point it would be well first to consider the value of the main fertilizer elements in a ton of straw, as most of this is eventually returned to the soil as the straw decays.

From the table it can be readily seen that each ton of straw has a worthwhile fertilizer value that should receive consideration when comparing the cost of a grass mulch system supplemented by straw with any other method of orchard soil management.

Cost of Straw Baled and Delivered.—The Purdue Orchard at Bedford is located in a farming territory where small grain crops cannot be used in many farm crop rotations. For this reason the local supply of straw is not nearly as plentiful as in many other orchard areas in the state. For the seven-year period, 1930-1936, from 50 to 70 tons of straw have been purchased annually for this orchard. In several years the straw had to be hauled a distance of 20 miles. The yearly cost per ton has varied from $4.50 to $7.00. The average delivered price of all straw bought during the seven-year period has been $5.60 per ton or 22½ cents per bale.

To maintain a desirable straw mulch on mature trees requires at least two bales per tree to start with and a bale per year thereafter. The Bedford Orchard has actually averaged only two-thirds of a bale per tree per year, but regardless of this fact the straw mulch has evidently been sufficient to prevent a high per cent of water run-off, and this has been noticeably reflected in tree vigor during dry seasons, such as 1930 and 1936.

The cost of scattering the straw under the trees has been from two and one-half cents to three cents per bale, which makes a total cost of approximately 25 cents per bale or $8.75 per acre (based on 35 trees.) The average grass and straw mulched orchard is mowed twice a year, resulting in an added cost of about $2.00 per acre. The cost of the straw, as a mulch, can be very logically reduced by at least $2.34 per acre (fertilizer element value of 1.4 tons of wheat straw) or to $8.41, which is certainly not a high cost per acre for this important item of orchard care.

During the past year several Indiana growers have reported the purchase of large amounts of straw at as low as 17 cents per bale delivered at the orchard. Practically every apple grower can obtain all the straw he wants by devoting a few days at threshing time to the purchase of his mulching requirements for the coming year.

QUESTION: Do you get increased profits?

PROFESSOR BURKHOLDER: I think I get increased growth and prevent run-off. I believe it is bound to react in increased profits. I never saw such a decided difference in the size of fruit as there was in the Bedford orchard this year, which was a very bad drought year. There was also a difference in the appearance of the fruit this year.

PRESIDENT COFFING: Thank you, Professor Burkholder, for that talk.

Is Howard Johnson present, he is on the Nominating Committee. If he isn't present I would like to appoint V. V. Clark to act on that committee in his place.

We have an important question to come before this meeting, and you are going to have a chance to express yourselves. I am going to ask Mr. Earl Byers to tell you about it at this time. Mr. Byers.

EARL BYERS: In the Soil Conservation Program of the Agricultural Adjustment Act, the benefit payments on farm crops have not been applicable to orchard land. They don't consider orchard practices as being justifiable to make any payment for certain practices that would conserve the soil, as is done in the farm agricultural procedure. They are in session here today and tomorrow and the 1937 program is to be threshed out. If we get any recognition in 1937, we will have to do it today and tomorrow. It is my suggestion that we have a committee appointed by this Society to represent the feeling of the horticultural people in this soil conservation program.

I might tell you that the Horticultural Department of the University, Professor Greene and others, have cooperated in setting up a recommended program. I have here a copy, but due to its length, I will not read it. It covers such benefits as soil which would help to control soil erosion, mulches, also cover crop systems that are now in orchards. We all follow such programs, but we are not in line to get any benefit payments for doing it. This last year the Knox County Society at Vincennes sent in a request to our state committee for recognition along the line of cover crops in the orchard—lespedeza in the apple orchard and rye in the peach orchard. We got an O. K. to Washington and feel we are in line to get benefit payments for those two things, but that program hardly fits the apparent needs of the fruit grower entirely.

I would suggest that the Chairman appoint a committee from this organization to meet this afternoon at one o'clock with the State Conservation Committee and do something towards working out a program that would fit the horticultural needs in Indiana.

Motion made and seconded that a committee be appointed to meet with the soil conservation men and present their question.

Committee: Earl Byers, R. A. Simpson, and Merle Troth.

Wednesday Afternoon

PRESIDENT COFFING: Our first subject this afternoon is "Engineering Problems Involved in Refrigerated Farm Storages." This is a subject of interest to all of us. Some of us may not have storages on the farm, but to a certain extent we are interested in them, and some are planning on storages later, and I know this is going to be an interesting subject. At this time we are going to call on Mr. Hienton.

T. E. HIENTON: Ladies and Gentlemen: The first man we want to present is Mr. C. E. Baker, a member of the Horticultural Department, who will open the discussion on fruit storages by relating some of his experiences and presenting some of the data which he has obtained on fruit storages in Indiana. Mr. Baker.

(Mr. Baker presented figures on the cost of construction and operation of cold storages now operating in the state. This material will be published as an Experiment Station Bulletin and will be available later.)

T. E. HIENTON: I think this report, if nothing else, calls the attention of you growers to the fact that Indiana is forging to the front in the matter of using refrigerated storages right in the orchards. Some of us are interested in refrigeration for agricultural purposes and have paid some attention nationally to the number of these storages. Professor H. G. Venemann, Refrigeration Engineer of Purdue, has prepared a discussion on refrigeration and some of the points which will be of interest to anyone considering such installation. I think the group is very fortunate in having Professor Venemann present this discussion. Professor Venemann.

ENGINEERING PROBLEMS INVOLVED IN REFRIGERATED FARM APPLE STORAGES

By H. G. VENEMANN, Associate Professor of Refrigeration,
Purdue University

There are two objectives to be accomplished by a refrigerating plant in an apple storage.

The storage should keep the fruit in good condition until marketed, and it should operate economically. It is generally conceded that the fruit must be in good condition when picked, it must be cooled within 2 or 3 days after picking to the temperature at which it is to be stored, and while in storage its temperature and humidity must be kept relatively constant.

Temperature

For most apples the best storage temperature is approximately 32° F. with a relative humidity of 85% or higher. Government tests show that apples soften twice as rapidly when stored at 40° F. as at 32°, almost twice as rapidly at 50° as at 40°, and twice as rapidly at 70° as at 50°. This indicates that apples held at 32° should keep about eight months as compared with four months at 40°, two months at 50° and one month at 70°.

If a grower is reasonably certain that he will market his fruit within four months, a 40° storage temperature would meet his requirements. On the other hand, a 40° storage temperature would, with reasonable certainty, compel him to sell his fruit within four months.

Humidity

It is difficult and expensive to maintain the ideal conditions of 32° and 85% relative humidity. At this temperature some of the water vapor will be continuously removed from the air, either by freezing on the cold pipes or by absorption in the cold brine, and a like amount must be added to keep the humidity uniform. Several excellent humidifiers are

on the market which introduce atomized water into the storage room.

The lower the room temperature and the higher the relative humidity, the greater will be the first cost of the refrigerating plant and the greater will be its cost of operation.

All of this has a direct bearing upon the engineering problems involved in the design of the plant. Any imperfections in design will be reflected in the keeping quality of the fruit and in the operating costs. Experience of the past indicates that the lower temperatures are more important than the very high humidities. For that reason most engineers prefer to sacrifice on humidity rather than on temperature. By so doing the first cost of the plant, as well as its operating cost may be kept down without greatly impairing the quality of the fruit or the duration of storage.

Storage Load

The storage load changes greatly from month to month and from year to year. The heaviest load comes during the picking season and continues for one or two months, after which it drops off throughout the winter almost to nothing. This may be seen clearly from Figure 1, which is a two-year record of the Coffing Brothers plant at Covington, Indiana. The peak load in 1931 occurred in October, at which time the refrigerating machine operated about 20 hours per day. In the following year the peak load occurred in September when 11 hours of operation per day was sufficient to take care of the temperatures. This dropped off to just a few hours' running per day for the remainder of the season.

Figure 1 also shows the maximum demand for each month during 1931-32. This high maximum demand after the load dropped off is due to the fact that there is only one compressor, one brine pump and one circulating fan with no method provided for cutting down the power requirements economically. The installation of two sets of units, or provision for reducing their speed would reduce the maximum demand. The capacities of the two compressors should be such that one will carry two-thirds of the maximum load and the other one-third. This combination gives the most flexible operation. It should be noted that a charge of $1.50 per month per kw. of maximum demand is made, in addition to the charge for current consumed

Calculating Loads

The unit of measuring load, "ton refrigeration," is the equivalent of a ton (2,000 lbs.) of ice melting from and at 32° F., or 288,000 B.t.u. (British thermal units). A machine which produces refrigeration at the rate of 288,000 B.t.u. during 24 hours of operation is called a one-ton machine. The load on the refrigerated storage is measured in terms of the number of tons of refrigeration. With a well insulated storage, having four inches of sheet cork on all walls, ceiling and floor, one may figure on one-half ton capacity per 1,000 bushels of storage space. For example, a 40,000 bushel storage should provide 20 tons of refrigeration machinery. This figure is approximate only. The engineer should

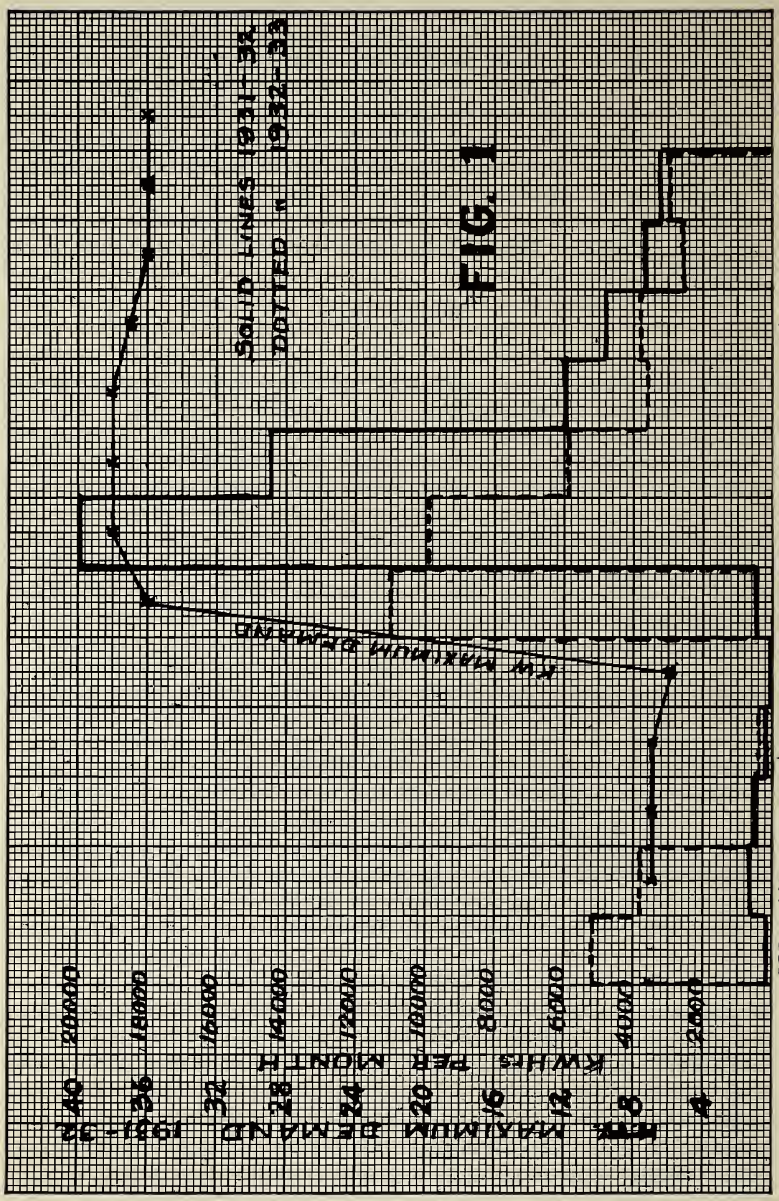
FIG. 1
KW. MAXIMUM DEMAND
KWHRS PER MONTH
SOLID LINES 1931-32
DOTTED " 1932-33
APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR.

figure every job separately, taking into consideration the square feet of exposed storage room surface, the probable outside and inside temperatures, the transmission value of the insulation and the maximum number of bushels of fruit to be cooled per day during the picking season.

As an illustration of this method of calculation the Coffing Brothers' plant will be used. It consists of three rooms, 100 ft. x 36 ft. x 10 ft. high, one above the other and one room 30 ft. x 20 ft. x 9 ft. high. All insulation is four inches of cork board or better.

Refrigeration Capacity Calculations

HEAT TRANSMISSION LOSSES

	Sq. Ft. Area		Temperature Outside—Inside		"U"		Hrs.		B.t.u's/day
Ceiling	4200	×	(80 — 30)	×	.067	×	24	=	337,000
Walls	8336	×	(70 — 30)	×	.059	×	24	=	471,000
Floor	4200	×	(70 — 30)	×	.065	×	24	=	262,000
					Total Heat Transmission Losses			=	1,070,000

1,070,000 ÷ 288,000 = 3.72 tons of refrigeration.

COOLING LOAD PER DAY 1,000 BUSHELS

Cooling 1,000 × 48 × (70° — 32°) × .86	=	1,568,000
Respiratory heat, 1,000 × 48 × 4,000 ÷ 2,000	=	96,000
Workmen in storage 4 × 500 × 10	=	20,000
Add for lights, air infiltration, etc. 10%	=	168,000
Total Products Load	=	1,852,000

1,852,000 ÷ 288,000 = 6.42 tons refrigeration.

From these figures we can make up a table of capacities based upon the rate at which the apples are picked and cooled.

TABLE I

TONS REFRIGERATION CAPACITIES REQUIRED FOR A 40,000 BUSHEL STORAGE

Bushels cooled per day	1,000	2,000	3,000	4,000
Heat transmission load	3.72	3.72	3.72	3.72
Cooling products load	6.42	12.84	19.26	25.68
Total load, Tons Ref.	10.14	16.56	22.98	29.40

From Table I it may be observed that the 20-ton capacity plant would be able to cool the apples at a rate between 2,000 and 3,000 bushels per day. If they were put into storage at a faster rate the apples could not be cooled to 32°.

Insulation

The question is often asked, "Will my building have to be insulated and how much will I need?" "U" in the Refrigeration Capacity Calculations is a coefficient of heat transmission, and, of course, changes with the thickness of the wall, ceiling or floor and the material of which it may be constructed, and of most importance, the thickness and kind of material used to insulate. A low value of "U" reduces the load, while a high value of "U" increases the load.

The following table will give the "U" value of a few typical constructions:

TABLE II

B.t.u. per sq. ft. per hour per degree = U			
8″ Brick wall, no insulation	0.385	8″ Hollow tile with 4″ cork board	0.061
8″ Concrete wall, no insulation	0.512	Wood frame with 4″ cork board	0.059
8″ Hollow tile, no insulation	0.317	Wood frame with 2″ cork board	0.098
Wood frame, no insulation	0.262	2″ Wood roof, no insulation	0.345
8″ Brick wall with 4″ cork board	0.062	2″ Wood roof, 4″ cork board	0.061
8″ Concrete wall with 4″ cork board	0.082	2″ Wood roof, 2″ cork board	0.126

An eight-inch hollow tile wall without insulation has a "U" value of 0.317 as compared with 0.061 with four inches of cork board, which signifies that 5.2 times as much heat will flow through the hollow wall without the insulation. On the whole it pays to insulate in this climate with materials that will be about the same efficiency as four inches of cork.

Evaporating Systems

There are five systems in general use for doing the actual cooling:

(A) Direct expansion with gravity air circulation.
(B) Direct expansion with forced air circulation.
(C) Brine coils with gravity air circulation.
(D) Brine coils with forced air circulation.
(E) Brine sprays with forced air circulation.

TABLE III

Power Consumption for the Five Systems

Cooling System	A	B	C	D	E
Room temperature	32°	32°	32°	32°	32°
Ammonia temperature	16°	22°	8°	14°	16°
Brine temperature	....	....	16°	22°	26°
Kw. hrs. per ton for compressor	28.0	24.0	32.0	28.5	28.0
Kw. hrs. per ton for air fan	....	8.0	....	8.0	10.0
Kw. hrs. per ton for brine pump	....	....	5.0	5.5	6.0
Kw. hrs. per ton for water pump	1.0	1.0	1.0	1.0	1.0
Total kw. hrs. per ton per day	29.0	33.0	38.0	43.0	45.0

It may be seen that system (A) is the most economical to operate, since there is no circulating fan or brine pump. It is likewise the cheapest to buy and install. Its most serious objection is the difficulty of maintaining high relative humidities. It is hoped that the atomized water vapor humidifiers will overcome these objections.

Mr. P. L. Sackett, in an article on Farmer-Owned Apple Storages, published in the August 1936 issue of *Refrigerating Engineering*, states that in Massachusetts they have discontinued the use of spray type units in favor of dry coil units having distributing duct work and forced air circulation. With these he claims that relative humidities above 85%, and 32°-34° F. temperatures were maintained.

Cost of Plants

From the valuation curve in Figure II we may get some idea of the cost of refrigerated storages. The cost values were obtained partly from figures submitted in a report by Dr. C. E. Baker, of the Purdue Horticultural Department, and partly from figures published elsewhere. They include the building, remodeling expense, insulation, refrigerating machinery and installation.

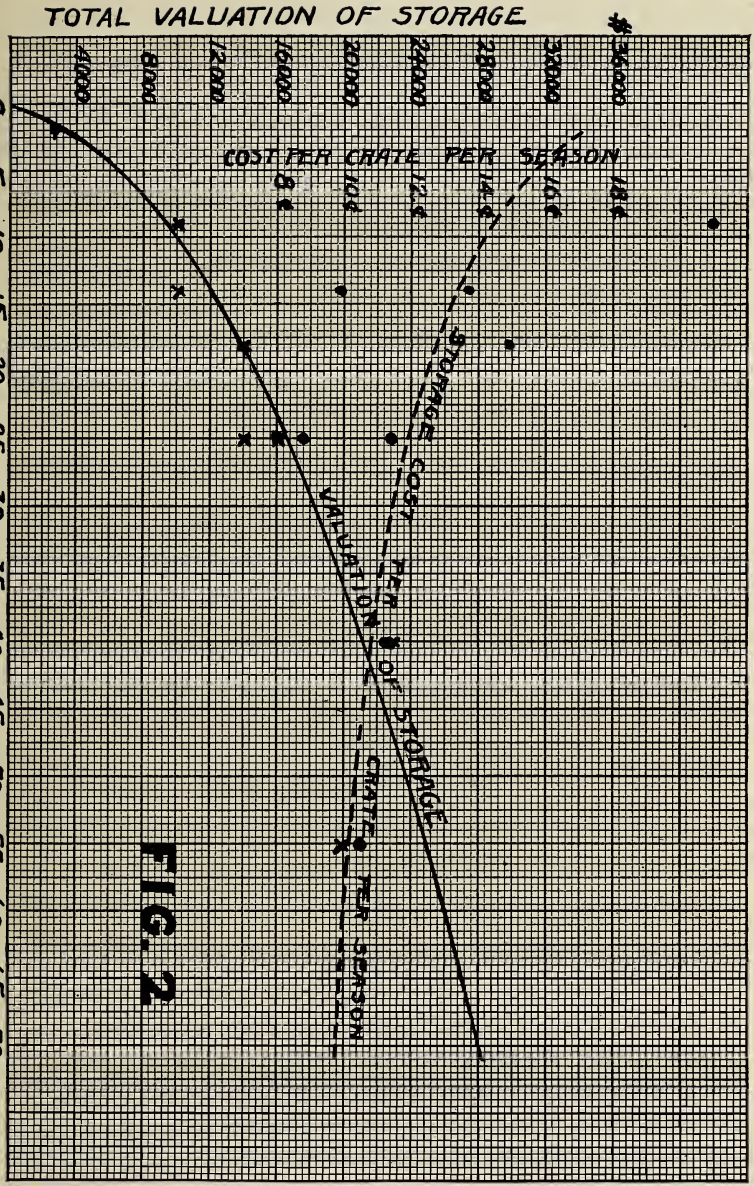
TOTAL VALUATION OF STORAGE.
$4000
8000
12000
16000
20000
24000
28000
32000
$36000
COST PER CRATE PER SEASON
10¢
12.5
15
17.5
20
22.5
25
27.5
30¢
VALUATION PER CRATE OF STORAGE
COST PER CRATE PER SEASON
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
CAPACITY OF STORAGE IN 1000 CRATES.

FIG. 2.

Had new buildings been constructed the cost would have been higher.

In Mr. Sackett's article referred to above he gives the cost of investment for a 16,500 bushel storage as $11,779 with the owner furnishing his own personal labor. He further states that the initial investment in his territory of Massachusetts will run from 60c to 90c per bushel.

The other curve in Figure II shows the cost per bushel per season for storing when filled to capacity, including all fixed charges and operating expenses. When the storage space is not fully utilized the fixed charges will remain the same, but the operating expenses will be reduced. In a well designed plant this operating expense should be almost directly proportional to the load imposed upon it.

It would appear from experience up to the present time that 10,000 bushels is the smallest farm cold storage that can be profitably operated. The ceiling height of the rooms should be about 12 feet. They are often as low as nine feet and as high as 16 feet. One should allow about 2.8 cubic feet per crate; about five cubic feet per basket and about eight cubic feet per barrel. This allowance gives ample room for aisles, coils and clearance between the containers.

QUESTION: Which is the most economical size compressor to operate?

PROFESSOR VENEMANN: A small compressor at high suction pressure is more economical than a large compressor operating at low suction pressure. A compressor operates most efficiently when the suction pressure is high and the discharge pressure is low, provided that the ammonia enters the compressor fully evaporated.

FRANK ODELL: Are there good insulating materials other than cork?

PROFESSOR VENEMANN: There are a number of good insulations, one of which is rock cork (not quite as good as pure cork). If there isn't much difference in price I would buy pure cork. Sawdust, hay, and hollow tile are not good insulations. A hollow tile 36 inches thick is not as good as 4 inches of cork.

PROFESSOR BAKER: At the Johnson storage they had a 12-inch wall and they put on 4 inches of cork.

QUESTION: Is there anything better than cork?

PROFESSOR VENEMANN: I don't know of anything.

QUESTION: What about ground cork?

PROFESSOR VENEMANN: Granulated or ground cork is a very good insulator in itself but it is very difficult to apply on anything except ceilings, even then it should not be covered with flooring, because it will dry rot the wood.

JOHN DYER: Couldn't you put it on the floor?

PROFESSOR VENEMANN: How would you adapt it?

PRESIDENT COFFING: You might put it on the concrete floor and put a wood floor over it.

PROFESSOR VENEMANN: You would probably get into a dry rot situation.

JOHN DYER: Does cork come from any place other than Spain?

MEREDITH REED: It comes from Italy also.

QUESTION: What about a wood outside wall?

PROFESSOR VENEMANN: It is all right, but so far as insulation value is concerned I wouldn't give much credit to the type of wall.

FRANK ODELL: Can't you use a rock wool between two walls?

PROFESSOR VENEMANN: Ordinarily it is not so good because of moisture absorption.

MEREDITH REED: Considering refrigeration from all angles, which one of the five methods would you consider the most applicable?

PROFESSOR VENEMANN: In the Yakima region in Washington, where there are a lot of apples grown, at one time over a period of two years there were something like twenty farm cooperative storages put up, and each one was designed like system B. These had direct expansion with forced draft and without any brine sprays. They seemed to get very good results. It is very economical to operate. However, the brine spray system will assure the highest humidity.

PROFESSOR HIENTON: Thank you very much, Professor Venemann. I will take this away from the Chairman and thank you on his behalf for coming here and presenting this discussion. I am sure this discussion has been very pertinent to the design of refrigeration equipment necessary for storages but there is another speaker to go on and I will turn this back to the Chairman, Mr. Coffing.

PRESIDENT COFFING: We will now continue our program as we have it outlined. At this time we are going to have a talk on "Marketing the 1937 Fruit Crop." We haven't it grown yet but we have to figure on what we will do with it when we get it grown. If we have a crop such as the one we had in 1931 we had better begin to figure so we are going to call on a very capable man to talk on this subject, Professor F. C. Gaylord.

FREEZING INDIANA FRUITS

By

F. C. GAYLORD, Horticultural Department

Purdue University Agricultural Experiment Station

The preservation of fruits and vegetables by freezing is a relatively young industry, but one that is growing rapidly into large proportions.

About sixty years ago mechanical refrigeration using ammonia compression came into use.

By 1905 some small fruits were being frozen in the eastern part of the United States for use by jelly manufacturers and ice cream makers.

In 1910 freezing as a preservative of strawberries and raspberries was introduced into the Pacific Northwest and since that time the volume of frozen fruits and vegetables has increased by leaps and bounds. In 1928 this region froze over 58,000,000 pounds of strawberries and raspberries. It is difficult to visualize such a volume of fruit but if all these berries were packed in 24-quart cases they would fill over 3,800 refrigerator cars—more berries than Indiana has produced during the last 15 or 20 years.

In 1930 nearly 82,000,000 pounds of fruits and vegetables were frozen in the United States.

Since this group is made up primarily of fruit growers, only the freezing of fruits will be discussed but it should be kept in mind that the frozen vegetable industry is keeping pace with frozen fruits, and that the field for frozen vegetables is just as large as that for frozen fruits.

With this brief background you are probably wondering what Indiana, through the Purdue Experiment Station, is doing in frozen fruits.

In 1935 the users of frozen strawberries in a large midwestern city were visited and their opinions and experiences obtained. Ice cream manufacturers, preserving companies and confectioners are the largest users and the consensus of opinion was that midwestern berries frozen could not be compared to those from the Northwest because out there a freezing berry (Marshall) which has lots of color and stands up well after freezing had been developed.

In recent years the Premier, a high quality berry not as adaptable to shipping as the Aroma, has been planted quite extensively in the southern part of the state. These local market berries, because they were not shippers, were seriously affecting the price of Aromas and any plan that would quickly get them off the market was welcomed. You all know that the Premier when ripe is a deep red berry throughout and for this reason meets one of the first demands of a freezing berry. The Premier in other sections of the country is rated as fair to good as a freezer, and it might well be added here that soil, climate, rainfall, etc., are probably important factors in making any fruit a good or a poor freezer.

In 1935 the Experiment Station froze a considerable quantity of

Premiers using a 3x1 dry sugar pack and a 50% sugar solution. A 3x1 pack means 3 pounds of berries and 1 pound of sugar. These berries were stemmed, washed thoroughly and all off-colored berries sorted out. They were packed in 5, 10 and 30 pound friction top, enamel lined cans because in these sized cans they would meet the demands of users who were rapidly drifting away from berries packed in barrels.

After being frozen the berries were stored in a commercial cold storage at 0° F.

Later in the year the same manufacturers who a few months before had reported midwest berries as poor freezers were again contacted and the Premiers displayed. In several instances the Marshalls from the Northwest were shown with Indiana Premiers and they created a very favorable impression. As a result, over a ton was sold to those manufacturers who didn't want them six months before. One reason why these berries compared so favorably was that a very good job of removing off-colored berries had been done.

Berries packed in a 50% sugar solution were harder to sell, and sold for less per pound than did those in dry sugar because the water used in making syrup was being paid for at frozen berry prices. It might be added that the Indiana Premiers were sold out in less than two weeks.

The strawberry freezing was carried on in 1936. The berries were all frozen using a 4x1 dry pack because the manufacturers using these berries could add sugar if needed as cheaply as we could, and at prices that were much higher than in 1935, the buyer was getting more berries than the year before.

Last year the Purdue Dairy Department used Indiana Premiers exclusively in making ice cream and they reported excellent results.

If the work is carried on in 1937, at least a 4x1 pack and probably a 5x1 pack will be used. Regardless of the pack used, the taking out of off-colored berries will be continued.

Indiana grown Staymans have been frozen for two years and in 1936, Rome, Delicious, Golden Delicious and Ben Davis were added. In 1935 the Stayman oxidized badly (turned brown), unless hurried from peeler to freezer. In 1936 all the varieties were treated with sulfur dioxide using 3,000 parts to a million parts of water. Oxidization did not occur even though the peeled apples were exposed to the air for a considerable period. These apples were pared, cut in fairly large pieces and packed 4x1. Reports from our Home Economics Department and a large pie baking company indicate that these apples compare very favorably to freshly peeled apples or any commercially frozen apples.

Latham red raspberries have been frozen with very good results using a 4x1 dry pack.

To give you men an opportunity to sample and examine these frozen fruits we have brought several varieties from storage and you will find the variety listed on the container.

QUESTION: Do you know what the proportion is of sugar in those products?

ANSWER: Three to one.

MEREDITH REED: Do you have any preferences with pie bakers as to the varieties they like?

PROFESSOR GAYLORD: Stayman apples are very good; Romes make good pies; in fact, I imagine any apple that will make a good pie in the fresh state will make a good one from the frozen product.

QUESTION: Does the freezing change the flavor?

PROFESSOR GAYLORD: Fast freezing doesn't hurt the color or the flavor.

QUESTION: Does it soften it?

PROFESSOR GAYLORD: If you use it soon, it doesn't soften much. The flavor and color of our strawberries are good.

HOMER COFFING: You don't have to hold the frozen products at zero all the time, do you?

PROFESSOR GAYLORD: I am glad you brought that up. Storage temperatures usually run from 10° to 15° F.

The Indiana "Seal of Quality"

The other thing I want to talk to you about very briefly concerns a plan which Professor McCown and I have been working on.

We would like to suggest to the members of the Indiana Horticultural Society that this "Seal of Quality" could be used to better standardize apple packs. As I see it we have a market in the midwest for real apples and we have one for "just apples." I have a feeling that we should be breaking into that upper crust. Boxed apples are common in our Indiana stores.

Professor Cleaver, fruit marketing specialist formerly at Purdue, has stated that Indiana growers could, by using good practices of growing and grading, produce a crop comparable in percentage of No. 1 apples to that produced in the West. In other words, we could pack a better percentage of our apples in the higher grades.

For the past three years we have picked random samples of the products of Indiana growers and found that hardly any two growers were putting up a similar pack of apples. It's true that we have had a grading and marketing law but there are several reasons which have shown that one can't be sure about the truth of what is on the lid. We should be able to put up at least a definite minimum standard.

Here is a little example of about what the seal might look like in its use as a distinguishing mark or brand which might be sponsored by the Indiana Horticultural Society as an agency seal. The grower could use this seal as long as his products met the requirements of the "Seal of Quality." The seal itself would consist of the Indiana Horticultural Society seal on a blue ribbon. A message of identification, etc., would accompany it. It would enable every educational agency in the state to get behind such apples. This little seal would be in addition to a grower's brand. The actual grade would be no lower than U. S. No.

1. The growers and the Indiana Horticultural Society could agree on the standards. We have made a tentative proposal as a mark to shoot at.

The certificate of agreement is included on the sheet which I passed out and although it will probably undergo some revision if this proposal is accepted by your organization, I think some of the basic parts of the agreement are included there at least.

JOHN DYER: Mr. Gaylord, they would have to be passed on by Federal Inspection, wouldn't they?

PROFESSOR GAYLORD: No, I don't think they would have to be but probably it would be safer. We should have men to check up on it to see that the growers are living up to their agreements.

HOMER COFFING: Suppose that on account of the weather conditions a man has nothing but average to poorer quality. Isn't it right to let him sell that fruit if he marks it correctly?

CHORUS: Sure!

JOHN DYER: I think the plan is very meritorious.

MEMBER: All the poor apples in Indiana don't come from Michigan.

JOHN DYER: And all the apples that come from Michigan aren't poor apples.

MEREDITH REED: I think the plan of branding apples will certainly help to sell more apples.

S. W. HOLMES: We should let the customer know exactly what he is buying; I think this is a cracking good thing.

MEREDITH REED: Mr. President, I don't think the Indiana Horticultural Society would prosecute a man who doesn't live up to it.

PROFESSOR McCOWN: If we're going to adopt a thing of this sort, let's have some teeth in it. I would like to ask Mr. Reed how he would suggest that this plan should be backed—what organization would you suggest?

MEREDITH REED: I have no definite suggestion at the present time.

PROFESSOR GAYLORD: Anyway, there are 23 baskets out of 25 upstairs that are not up to the standard for which they were marked. We're going to have to improve that in one way or another.

MEMBER: How does that compare with past years?

J. E. DICKERSON: It's worse this year than in other years. . . .

PROFESSOR McCOWN: It seems to me that there are two questions before the Horticultural Society now that should be answered.

First, does this organization want to back the grade law? Second, are there a dozen Indiana growers who would be interested in taking this idea and working toward the plan of using it?

JOHN DYER: I think the Resolutions Committee should take care of that.

L. A. BOYD: Mr. President and members of the Indiana Horticultural Society: I have been listening to the line of talk relative to the poor grade of apples that come over from Michigan to Indiana; we're always having one state blaming another and even various areas in the same state frequently have their differences.

I'm pretty familiar with the Michigan situation and as to the Benton Harbor market, I want to say that the poorer grades of Transparents and Duchess come on this market and raise as much hob with the Michigan grower as they raise with you on their winter varieties.

Peaches come on this market that are filled with Oriental peach moth, too.

There are four inspectors in Michigan to one in any of the other apple producing states. The market is a common ground for growers and buyers to meet; they go the limit to advertise midwest fruit and your growers put a vast amount of produce over it and get a large benefit from it. It looks a little like the case of the pot calling the kettle "black" and the arguments of one apple producing state panning its neighbor won't increase the sales of apples. The new Indiana Horticultural label is a fine thing; the main idea is to live up to it.

The fact remains that the apple industry has lost 29 per cent of its consumption in the face of increase in other fruits and in the face of this showing, I feel that it is time to do something constructive to regain this huge loss. I had the pleasure of sitting in at a meeting this week at Benton Harbor, Michigan, which was held to put on a progressive campaign to reclaim some of this lost business. Mr. E. Stuart Hubbard, a wholesale commission man from New York City and also a large grower of apples, gave the Michigan growers some very good advice and they are acting on several of his ideas.

Remember, it costs $2.05 per box to bring a box of Western apples to New York and sell it through the auction. In the face of this, the Eastern growers can make good money meeting this competition.

The New York-New England Apple Institute was started as an outshoot from the National Apple Institute but was applied as a regional proposition to New York and the New England States. They hired a manager and made a small assessment per bushel to put it over; they raised $17,000 for the first year's campaign.

The manager contacted the chain stores through their main office. A sample idea of their contact questions with a view toward getting the interest of the A. & P. chain would include:

QUESTION: How many stores does your chain have in Washington?

ANSWER: Seven or eight.

QUESTION: How many apples do you buy from that section?

ANSWER: About $2,500,000 worth per season.

QUESTION: How many stores do you have in New York and the New England States?

ANSWER: Considerably over a thousand.

QUESTION: Do you think your policy is equitable in view of the fact that the Eastern growers are your customers in such a large way?

This approach brought considerable thinking; at least the result was that the chain stores agreed to push the apples raised in that section. The price on McIntosh was $1.25 per bushel at that time, but after they were assured that the growers were making no profit at that price they agreed to pay $1.50. They also agreed to advertise the local grown varieties as McIntosh, Northern Spy, R. I. Greening, King and Baldwin in their store magazines.

The Apple Institute also furnished display cards that were put up in a very neat shape and in conspicuous places in both chain and independent stores calling the attention of the buying public to the good qualities of the varieties grown locally.

I was in New York two weeks ago and made it a point to look in on some of these chain stores; the impression was good and the clerks took a pride in pushing the home grown products.

As for the National Apple Institute, the Eastern growers feel that the West would get the most out of it and they would much prefer to handle the deal in a regional manner and I feel that they are right. With a high freight rate against Western apples, we can make good money on our fruit on the same basis but we will have to give the consumer and dealer a clean and honest pack.

As far as the Mid-west is concerned, Ohio, Michigan, Indiana, Illinois and Wisconsin comprise most of the apple production territory and we have several large primary markets in Detroit Cleveland, Grand Rapids, Chicago, Indianapolis and a lot of other large manufacturing cities to cater to and increase our apple sales.

I don't want to transgress any further. I feel though that you might want to get Mr. Hubbard down here to talk to your group some time. We should forget the petty sins of our neighbor growers and pull together to get back the lost sales of apples—Nature's finest fruit. Thank you.

FRANK FARNSWORTH: The growers around the Cleveland section are getting together and are advertising with electrically illuminated ads. They are also using the radio in advertising northern Ohio apples. Just what teeth they are putting into enforcing their packing, I am not in position to state.

PRESIDENT COFFING: Thank you Mr. Boyd and Mr. Farnsworth for your interesting information.

I am sure we have been very much interested in the things Professor Gaylord had to tell us. It looks like we are coming into a little broader field of marketing our apples and it looks very promising. This is the end of the regular program for the day but I would like to call for an election of the officers before the evening banquet and while more of us are here. Is the Nominating Committee ready to report?

Mr. Holmes, Chairman, read the report and the motion was made and passed, requesting the Secretary to cast the unanimous vote of the Society for the nominees.

Merle Troth, Orleans, was elected president to succeed Mr. Coffing, and Victor Judson, Bristol, was elected vice-president. Mr. Troth is one of the better large apple growers in the southern part of the state and Mr. Judson is one of the better growers of a diversified program of fruits in the north section of the state. Both are good leaders and should serve the Society well.

Mr. E. V. Hawkins, Mitchell, was re-elected as a member of the Executive Committee and Mr. B. L. Billingsley, Greenwood, was re-elected as a member of the Legislative Committee. Mr. William M. Walton, LaPorte, was re-appointed as a member of the Advisory Board of the Purdue University Agricultural Experiment Station.

It is the hope that all of these men will be very successful throughout the year in handling their duties in the interests of the Indiana Horticultural Society membership.

HOMER COFFING: I hope all of you will be at the banquet in about an hour. Adjournment.

HOOSIER HORTICULTURAL BANQUET

The banquet was declared by many as one of the best ever held by Horticultural followers. Approximately 175 persons attended this joint dinner held by members of The Indiana Horticultural Society, Indiana Vegetable Growers' Association, Northern Indiana Muck Crops Growers' Association, and the Indiana Potato Growers' Association.

After a delicious, well-served meal beginning with Hoosier spiced apple juice and closing with fresh frozen strawberries and ice cream, Dr. Laurenz Greene, chief of the Purdue Horticultural department, introduced the Toastmaster of the evening who was none other than our old standby—John Napier Dyer. The latter proudly exhibited his red tie which has become a characteristic tradition of the banquet, (he also wore red socks) after which various leaders were introduced.

The list in order of introduction, included Professor Ira C. Hoffman, Ohio Agricultural Experiment Station, Wooster, Ohio; R. A. Simpson, past president of the Indiana Horticultural Society and representative of the Purdue Board of Trustees, Vincennes; Homer Coffing, president, Indiana Horticultural Society, Covington; Ray Morgan, president, Potato Growers' Association, Knightstown; E. L. Mitchell, president, Muck Growers' Association, Rochester; Professor Harry J. Reed, Assistant Director, Purdue Agricultural Experiment Station, Lafayette; Pro-

fessor Frank R. Hall, Banquet Speaker and member of the History and Economics department at Purdue; Guy Cantwell, member of the Indiana State Fair Board, Gosport. Several of the "celebrities" spoke very briefly. Mr. Cantwell, who has been in charge of the Agricultural and Horticultural Exhibit building at the State Fair for several years, spoke very highly of the fruit and vegetable exhibits and asked for suggestions from the growers. The State Fair is practically the "lone window" through which many Indiana people see Indiana Horticulture on exhibit.

Professor Hall delivered a very enlightening address upon the complicated situations leading up to or accompanying the war clouds of the Spanish Revolution. Practically all horticultural troubles were temporarily forgotten as each person listened attentively to the clear and concise presentation of the conflict from the viewpoint of a very active historian.

Dr. Greene briefly mentioned the First International Horticultural Exposition held in September at Chicago. He called attention to a long list of horticultural pictures taken at the Exposition. Indiana, through very good cooperation upon the part of a number of men, won first honors in the State Exhibit class. A Wilder medal represented part of the award although it had not been received at the time of the Annual Meeting.

Professor W. E. Lommel represented the Horticultural Department in the presentation of awards to high school winners in the annual Purdue Horticultural Judging Contest. Medal winners in apple judging included Dale Wright, Pierceton; Melvin Weil, Evansville; and Fred Leemaster and George Pugsley, Jr., Anderson. Medal winners in vegetable judging were Russell Smith, Otter Creek; Clifford Breeden, Klondike; and Everett Wichmann, Klondike. Two of these boys were high winners in the National Vegetable Judging Contest which gave Indiana first place. Coaches of the medal winners were W. C. Kolb, Anderson; F. P. Jacques, Evansville; Walter Weber, Otter Creek; Harry Q. Holt, Klondike; and E. E. Clanin, Pierceton. All were able to be present as our guests except Coach Clanin and his gold medal winner, Dale Wright. The medals, made up with a very attractive horticultural display as a foreground, are awarded annually by the Indiana Horticultural Society and the Indiana Vegetable Growers' Association.

Mr. F. C. Baase, Purdue student and accomplished xylophone player, and the Pitchers 4, a very widely appreciated colored quartet from Indianapolis, provided numerous entertaining musical numbers.

Morning Session

PRESIDENT COFFING: We'll have the committee reports first this morning. Mr. Byers, are you ready to report on the Soil Conservation program?

EARL BYERS: The committee met with the state conservation committee and a federal representative of the national set-up from Washington yesterday afternoon. We spent considerable time in trying to explain to members of this committee, who are mostly farmers in touch with other lines of agriculture and horticulture, the necessity of a dif-

ferent set-up for horticulture in the soil conservation scheme but found we were up against it as far as the 1937 program is concerned.

Benefit payment is available to the orchardist on the basis of $1.00 an acre that can be earned in various ways. The planting or seeding of one of the legumes as a cover crop or the seeding of rye is sufficient to qualify for the payment of $1.00 an acre. This cover crop can be mowed down and left on the land, not taken off, or it can be disced under. Either practice would qualify for the benefit payment of $1.00 per acre. The addition of mulch in the form of straw or any other available mulch material can be hauled into the orchard and a value of 75c per ton, limit of three to five tons per acre, will be credited on that $1.00 an acre or the total acreage. If you put four tons of straw on an acre there is a value set up of $3.00 on the acre. You don't get the $3.00 but it can apply on three acres. If you mulch one-third of your hundred acres at the rate of four tons per acre it will qualify you for the payment of $1.00 per acre on your hundred acres. You can get a benefit payment for the application of limestone at the rate of $1.25 per ton and this can also be spread over your entire acreage or it can all be put on one acre and draw the benefit payment of $1.00 per acre if you spend enough for lime. As we understand it, it is limited to $1.00 per acre, but it can be qualified for in three or four different ways. We tried to convey to this committee that this was not adequate from the standpoint of the horticulturist as he spends $10.00 an acre for the upkeep of his soil where an agriculturist spends probably $1.00 and there should be additional benefit payments accumulative and it should be possible to do three, four, or five of these and get paid for them.

I think that Mr. Troth, Mr. Simpson and Professor Greene did a very good job of selling the men of the committee their idea of thinking although we can't affect the 1937 set-up as it has already been O. K.'d. This committee is an open-minded bunch of men and solicited recommendations from our society. They didn't know very much about the needs of a horticulturist and were very receptive of any suggestions made and asked us to recommend any changes for another year that would apply to our business.

JOHN DYER: I move that the report of this committee be accepted as read and the thanks of the society be conveyed to the committee for their fine work.

Motion seconded by L. V. Doud, and passed.

PROFESSOR GREENE: Some of you are growing sod orchards. You may not want to apply straw, some may have alfalfa and there is no provision there. The growing of sod should receive benefit payments. The contention of the Soil Conservation Administration is that a man must do something to earn his dollar. If he already has a sod in his orchard he doesn't earn it; they are paying payments on the basis of the conservation of an acre of soil regardless of crops grown on it. I hope they will make some provision for a sod orchard.

R. A. SIMPSON: The crop doesn't have to be a legume crop. It can be a mixed legume and some other crop.

EARL BYERS: We spent considerable time, after we found this particular part of the program was already provided for 1937 and there wasn't much chance to change it, in feeling out this state committee on the idea of reduction in crop as they provide for in the agricultural program for corn in which they pay 15 per cent reduction of the soil depleting crops turned over to a soil building crop. I wonder if that would apply to horticulture. We could do away with a certain percentage of our questionable apple trees or unprofitable varieties if there was an adequate remuneration for doing it as in corn, or at least leveling of the peak of our production on our high producing years by taking off the fruit on certain varieties we think unprofitable or on certain acreage that is for some reason questionable. It would at least remove some of the competing low quality fruits on the market for that year. I think in the course of the next year or two, if we place that problem with this committee and get action by the society over territory enough that we will get something through of that kind. It will have to come from cooperative work.

FRANK ODELL: I move that this committee not be discharged but remain active to continue these conferences if there seems to be any opportunity to reopen the subject.

Motion seconded and passed.

MERLE TROTH: Any program they can see fit to work out for fruit growers to adopt must be a national program and for that reason it would have to be given great consideration for the entire country rather than to Indiana alone.

PRESIDENT COFFING: I want to introduce the new president and vice-president. Will these two gentlemen please come forward.

MERLE TROTH: They took advantage of me yesterday when I was in the committee meeting. I would much prefer that someone else was president for the coming year. I deeply appreciate your confidence; I can't say so much for your judgment. The duties of a president, as I see it, are not to get out and do the work but to see that the other fellows do the work. With your help, we will all do our best for 1937 and I hope I don't fail you.

HOMER COFFING: May we have the report of the Resolutions Committee?

MERLE TROTH: Yes, I'll read the five resolutions.

1. WHEREAS, a law passed by the 1935 Legislature for the protection of Indiana fruit and vegetable growers, known as the Dyer law, is not being enforced; therefore, be it resolved that we urge the complete and immediate enforcement of the Dyer law, and we recommend that the President of the Society request the Legislative committee to call upon the Governor, acquaint him of the law's non-enforcement, and urge his cooperation in gaining its prompt enforcement in the interest of the fruit and vegetable industry of the state—and, that we demand sufficient appropriation for the enforcement of this law.

2. WHEREAS, since the 1937 program of the Soil Conservation com-

mittee as it pertains to the fruit grower, is already determined, and since we feel that the base used to figure the fruit grower's status in this matter is apparently erroneous, we urge this committee, after securing the true facts of the case, to give this matter careful consideration for 1938.

3. WHEREAS, the United States Department of Agriculture, through its laboratory at Vincennes, is supplying fruit growers with valuable information relative to insect and disease control; therefore, be it resolved that we herewith express our appreciation to the individuals present from Vincennes and instruct our Secretary to send a copy of this resolution to the respective Bureaus of the U. S. D. A., expressing our appreciation and our hope that the work may be continued and enlarged as the opportunity presents itself.

4. WHEREAS, due to lack of facilities, we urge the immediate completion of the building program for the Horticultural building in order that we may further the interests of Horticulture in Indiana and provide for an increased staff in this important phase of Agriculture.

5. WHEREAS, the smiling and congenial face, and the good counsel of our Dean, J. H. Skinner, is missing from this Annual Meeting of the Indiana Horticultural Society, be it resolved that we, the Society members, extend to him our united hope for a speedy and full recovery from his present illness.

Respectfully submitted,
M. S. TROTH, Chairman
L. V. DOUD
FRANK I. ODELL

The report was adopted.

PRESIDENT'S ADDRESS

HOMER COFFING: I think Mr. Simpson is Chairman of the Committee on the President's Address. Are you ready to report?

R. A. SIMPSON: The Committee on the President's Address reports as follows:

The President gave a splendid address. It was timely, full of valuable information and advice and it contained valuable historical information as to seasonal conditions and activities of 1936. We recommend that the members review it carefully.

Respectfully submitted,
R. A. SIMPSON, Chairman
E. V. HAWKINS

The report was adopted.

SECRETARY-TREASURER REPORT

MONROE McCOWN: Mr. Chairman, the auditing committee has examined the accounts of the Secretary-Treasurer and finds them correct as reported. Mr. Chairman, I move the adoption of this report.

Respectfully submitted,
MONROE MCCOWN, Chairman
MEREDITH REED

Report adopted.

OBITUARY COMMITTEE

EVERETT WRIGHT: Mr. Chairman, I don't believe Professor Burkholder is here at the moment, but we have no knowledge of any deaths to report with the single exception of Professor Robert A. Ogg, who passed away at Greencastle on May 12, 1936, at the age of 87 years. Even though he lived to an advanced age, his life was so full of many helpful interests, including a keen interest in horticulture, that all who knew him were sorry to learn of his passing.

If we learn of other deaths before the printing of the Annual Report, they will be included in the Report.

Respectfully submitted,

C. L. BURKHOLDER, Chairman
EVERETT WRIGHT

Report adopted.

SECRETARIAL NOTE: Recent postffice records on the return of first class mail have given us official notification of the passing of R. L. Beck, R. R. 5, Liberty, and Samuel A. Hazelett, Greencastle. The name of L. B. Custer, Logansport, whose death had been reported previously, has been erroneously continued in the list of Life Members.

The untimely accidental death on November 14, of E. R. Chandler, R. R. 6, Terre Haute, was recently reported in correspondence with his widow, Mrs. Lela D. Chandler, who continues to promote and carry on the horticultural interests of Mr. Chandler. We regret to learn of the passing of Frame C. Brown, Worthington, Ohio. His membership in our Society exemplified his broad interests in horticultural pursuits. We lament also the passing of E. J. Jacoby, Indianapolis, one of the older attorneys of that city, and whose amateur horticultural interests gave him much real enjoyment.

May each member of the Indiana Horticultural Society, upon the reading of this report, pause briefly in silent tribute to the memory of our departed associates. It is our hope that we who remain may be able, in some small measure, to continue their interests in the greater appreciation and realization of horticultural endeavors.

THE SECRETARY.

HOMER COFFING: We always like to hear from the Entomologists. I think Professor Davis is going to take charge of this part of the program and we'll let him present his material and make the other introductions. Professor Davis.

ORCHARD INSECT PROBLEMS

J. J. DAVIS, Head, Entomology Department

Purdue University Agricultural Experiment Station

The codling moth continues as the major problem in fruit insect research, and yet we must not overlook or forget that there are other insect problems which must not be neglected for some are certainly problems of major importance. Therefore, before introducing the subject of codling moth control, may I say a word regarding the status of a few other problems.

Oriental fruit worm. In southern Indiana the severe winter of 1935-36 killed many peach trees, and eliminated a 1936 fruit crop for the remaining trees. As a result this pest received a temporary setback in the southern half of the state. However, in a few northern Indiana orchards which produced a crop of peaches, the Oriental fruit worm built up to threatening numbers for 1937.

The Oriental fruit worm has been fluctuating in abundance from year to year and the governing factors seem to be largely weather conditions, especially drought, and the presence or absence of a crop. Its ability to reappear in large and destructive numbers with favorable conditions following conditions which have reduced it to negligible numbers is an obvious fact.

The introduction of foreign parasites has been continued by the Federal Bureau of Entomology, but as yet none, excepting *Macrocentrus ancylivorus* introduced first by Purdue from New Jersey several years ago, have been recovered, but it is too early to conclude that the introductions have not survived. In the case of *M. ancylivorus*, recoveries have been made, with one exception, only from Knox County and nearby territory. Here the parasite is evidently well established and it is hoped assistance will be made available to collect infested twigs and rear parasites from this region for redistribution to other points. It should be noted that introductions have been made in many orchards in different localities in the state and apparently the reason for the establishment of the parasite in Knox County and not elsewhere is due to the concentration of peach orchards in Knox County and their isolation in most other regions. The exception already mentioned is in the case of the recovery of a single specimen in 1936 in the Sam Holmes Orchard at Mitchell.

Black peach aphid. In some localities in the state where peach trees were killed by the severe winter, new plantings have been made on the exact site of old trees. This is likely to result in severe infestations of the black peach aphid which may be very serious to young trees although unnoticed on older trees. Perhaps a nitrate fertilizer will aid trees in overcoming possible injury. Perhaps, also, the paradichlorobenzene treatment as for the peach tree borer will give control although we know of no tests to determine this point.

Peach tree borer. We are not as yet recommending a liquid application of paradichlorobenzene to replace the present practice of using dry material. There is no evidence that it is any better, if as good, as the dry application, the cost is greater and it does not appear as practical.

Seventeen year cicada or "locust." As anticipated, the 17-year cicada appeared in most regions of the state, being most abundant in the southern half. Recent plantings of fruit trees, especially those near timber areas, were severely damaged and in some cases ruined, in spite of the fact that certain nursery men criticized the station for warning, a year ago, against plantings in such locations. We again offer this warning to fruit growers in the southwestern "pocket" area where the 13-year brood is scheduled to appear in 1937.

San Jose scale. There is every evidence the scale is again building

up. It will be especially difficult to control on trees scarred with egg punctures of the cicada. Careful examinations should be made for scale and with the least indications of infestations, treatment should be made without fail. Past experience warns us against permitting the scale to gain the least headway.

Leafhoppers on apple. Throughout the state apple leafhoppers are becoming recognized as pests of prime importance. In orchards where oil is used consistently with arsenicals as stickers, spreaders or ovicides, the leafhopper seems to be held fairly well in check. Elsewhere its prevalence leads us to recommend the use of a contact spray, such as nicotine or pyrethrum, as a special spray to control these pests. Perhaps few of us realize the possible damage which leafhoppers may cause and in fact we have insufficient proof to demonstrate their damage. We do have one observation made in the V. V. Clark Orchard at Bristol where control of the leafhopper with a nicotine-oil spray resulted in increasing the diameter of apples between ¼ and ½ inch. This one test is insufficient proof but it is fairly good evidence of damage likely to be attributed to leafhoppers.

Codling moth. A history of the codling moth the past two years illustrates how quickly this insect can reappear in very destructive numbers following conditions which all but wipe it out. The cold wet season of 1935 was very unfavorable to codling moth and they went into hibernation in very few numbers. The severe winter of 1935-36 did not aid the insect and the carry-over in 1936 was very small. However, from the beginning of the 1936 season weather conditions were ideal for codling moth development and increase, resulting in a late summer infestation that was almost unbelievable. At present the codling moth is wintering over in large numbers and with normal conditions in 1937 we can anticipate an abundance of trouble from this insect.

In the northern third of the state we had fine cooperation from five growers in keeping records of moth catch in bait traps which enabled us, for the first time, to give some aid in timing sprays. We expect to continue this cooperation this coming season and believe the aid will be appreciably greater with the experience of the past year.

Our research studies at Orleans have been continued and somewhat enlarged with G. E. Marshall in charge, who will shortly present to you the results of his season's work. The studies have featured spray schedules and new or improved spray materials and combinations.

For three or four years, Marshall's results have enabled him to advocate more frequent, heavy and more adhesive sprays early in the season to build up a heavy coat of insecticide and thus secure practically complete control of the first brood. It is even believed that for some growers and for some seasons, it may be possible to secure such a complete control of the first brood that further spraying that season may be omitted.

This same idea is being advocated by James Marshall of the Washington State Agricultural Experiment Station, based on three years of work. His statement reads, "The grower can apply his four or maybe five cover sprays during the first brood and put his spray nozzles away. His spraying is over for the season with nothing more to worry about

from codling moth." He calls it the dynamite spray (lead-dynamite and calcium-dynamite) and I have learned that the original reason for the name was not because of its effectiveness but rather because it was thought at first to be almost as dangerous a recommendation as the use of dynamite. As our Mr. Marshall will tell you, we have similar ideas regarding the heavy first brood sprays and although it may be possible in some cases and under certain conditions to lay aside the spray nozzle after the first brood, we certainly would not make such a definite statement for Indiana.

PROFESSOR DAVIS: I think, Mr. President, with these introductory remarks we can get down to business and I will call on Mr. Marshall for his results at this time. Mr. Marshall.

RESULTS OF THE 1936 SPRAY PLOTS

G. Edw. Marshall

Department of Entomology

Purdue University Agricultural Experiment Station

In 1936 the spray tests were of two-tree plots triplicated on two varieties (Grimes and Delicious). Late freezes reduced the fruit set somewhat. The crop was light on Grimes but satisfactory on Delicious. No trouble was encountered from apple diseases. Eighteen days elapsed between the last application of sulphur and the first codling moth cover spray. Inasmuch as plots for the control of apple scab preceded the codling moth studies in the orchard, the plotted area received five different kinds of sulphur with no resultant injury. For this reason the kinds of sulphur used should be mentioned. They were flotation sulphur paste, flotation sulphur powder, liquid lime-sulphur, wettable sulphur, Kolofog, and Dritomic sulphur. Large enough blocks of these materials were used so that each of the twelve codling moth treatments was applied to some trees which received each of the different kinds of sulphur.

Weather Conditions

Weather conditions were outstanding throughout the entire season. After a period of low winter temperatures which were very severe on apple trees, subnormal temperatures occurred at blooming time. Plant developments were brought to a standstill by excessive heat and drouth early in the season. A careful study of the rainfall and temperature records, while outstanding enough, do not present a true picture of the severity of the actual conditions because, during the periods of greatest intensity, high wind velocity was common and this, coupled with low humidity, was definitely injurious to trees. In addition, hail injured many of the orchards in both Lawrence and Orange counties which included both orchards in which our studies were conducted.

Residue Analysis

Seven sets of samples for residue analysis were taken during the spray season. Samples of all the treatments in which lead and arsenic

might present a removal problem were included. After June 1, such samples were taken after each spray application. These were weighed immediately and sent to O. W. Ford of the office of the State Chemist for analysis. Between June 24 and July 2 two samples were taken, with the second collected immediately after a rain of more than two inches. A sample was taken just before harvest, and at harvest two more were collected, one of which was washed in a flotation washer with an underbrush pre-dip and the other one washed in an underbrush flood machine. In all there were ten sets of samples taken.

The Codling Moth Conditions

Growers with whom the department has cooperated directly for the past several years had such a low population of codling moth during the winter and spring of 1936 that new orchards had to be selected for plot work. The work was conducted for the most part in the Purdue Experimental Orchard near Mitchell, Indiana, and here the infestation had been so light for a number of years that it was necessary to provide an artificial infestation with which to work. This infestation developed into a very heavy population by midsummer so that the results obtained were rendered more valuable thereby.

The Spray Schedule

The complete spray schedule is given in Table 1 and aside from the injury from spray materials as noted in the table of treatments, a moderate to heavy drop of yellow leaves occurred on July 1 to 5. This was not restricted to any certain plots but was general over the entire section. On July 25, the second fall of yellow leaves occurred and most of them came down during a rain of more than two inches. This was also general and not limited to any certain plots. The heat and drouth became so severe by August that all orchards in this vicinity were showing its effects. The severity of the drouth damage increased almost daily until the middle of September. For this reason it was impossible after the middle of July to tell slight or even moderate injury caused by spray materials as separated from that of drouth. Trees carrying the greatest loads of spray materials wilted first and most severely. This was especially true when such trees carried a heavy load of fruit. Suffice it to say that none of the materials used under the conditions of this experiment caused injury of any commercial importance.

The Flights of Moths

In the Experimental Orchard, moth flight became heavy about a week earlier than was normal for the other orchards of this section. There was a lull in flight about a week later, then another heavy flight began, then another lull and about a week or ten days later another heavy first brood flight occurred. In other words the first brood flight began a week early and continued a week longer than the normal for that area. At the Harbaugh Orchard where all the tests were duplicated, the infestation in previous years was heavier than normal for the region but with three heavy applications in 1936 the codling moth attack was definitely checked.

Infestation Results

The calyx spray was omitted; this was done in order that the infestation might build up to a population big enough to give convincing infestation counts without impairing the value of the data. The efficiency of the spray materials was determined by counts of side and stem entries made by larvae in both dropped and picked fruit. The calyx entries were recorded separately because no calyx spray was applied and no control from calyx entries could be expected. The number of calyx entries

TABLE I. SUMMARY OF RESULTS OF CODLING MOTH CONTROL EXPERIMENTS

Plot No.	Treatment on Basis of 100 Gals. (6 cover sprays unless otherwise indicated)	Average of Two Orchards (Experimental and Harbaugh Orchards)		Comments
		Stings per 100 Apples	Worms per 100 Apples	
1	3 lbs. lead arsenate (Corona) 6 lbs. lime	69.1	58.6	
2	DX 67—1⅓ pints			Discontinued Aug. 15 when infestation was 87 worms per 100 apples.
3	3 lbs. zinc arsenate (General) 3 lbs. lead arsenate (Corona) 2 qts. Ortho K 8 ozs. soap chips	22.0	9.5	Soap reduced to 7 ozs. in 3rd and later covers.
4	4 lbs. zinc arsenate (General) 8 ozs. ferric chloride 2 qts. Ortho K 8 ozs. soap chips	28.0	24.1	Soap reduced to 7 ozs. in 3rd and later covers. Ferric chloride reduced to 6 2/5 ozs. in 4th and later covers.
5	4 lbs. cal. arsenate (Niagara) 6 2/5 ozs. zinc sulphate 2 qts. Ortho K 8 ozs. soap chips	42.9	29.5	Soap reduced to 7 ozs. in 3rd and later covers.
6	4½ lbs. Bentonite 1 pt. Black Leaf 40 4 ozs. dry milk powder	17.8	47.1	Reduced Bentonite to 3 lbs. in 5th cover. Two qts. oil added in 6th cover.
7	4 lbs. Alono Cryolite 2 qts. Ortho K 8 ozs. soap chips	14.7	30.8	Soap reduced to 7 ozs. in 3rd and later covers. Reduced Cryolite to 3 lbs. in 4th and later covers.
8	4 lbs. lead arsenate (Corona) 2 qts. kerosene 8 ozs. soap chips	33.6	14.0	Soap reduced to 7 ozs. in 3rd and later covers. Lead reduced to 3 lbs. in 6th cover.
9	4 lbs. lead arsenate (Corona) 1 qt. Nopco fish oil soap 2 qts. Ortho K	20.2	8.0	Soap reduced to 1 pt. in 3rd and later covers. Lead reduced to 3 lbs. in 4th and later covers. Replaced Ortho K with Gulf oil in 6th cover.
10	4 lbs. lead arsenate (Corona) 2 qts. Ortho K 8 ozs. soap chips	9.1	6.2	Soap reduced to 7 ozs. in 3rd and later covers. Lead reduced to 3 lbs. in 4th and later covers.
11	4 lbs. lead arsenate (Corona) 2 qts. Gulf Oil No. 702 8 ozs. soap chips	15.2	4.1	Soap reduced to 7 ozs. in 3rd and later covers. Lead reduced to 3 lbs. in 4th and later covers.
12	4 lbs. Latimer lead arsenate 2 qts. Petrocide	63.6	26.9	Lead reduced to 3 lbs. in 4th and later covers.

should be of considerable interest inasmuch as several growers have been contemplating the omission of this application as a method of curtailing operating expenses. The calyx spray should *always* be applied.

Suggestions

The past three years of cooperative work with growers, notably Messrs. M. S. Troth and H. V. Elrod, and plot studies, point to but one method of procedure in codling moth control. The greatest emphasis must be placed on first brood control through the use of several heavy applications begun immediately after calyx and continued at seven to ten-day intervals until June 20. For heavy or increasing infestation lead-oil-soap combinations have been found most effective, and under the conditions of the commercial orchardist the residue can usually be removed to the federal tolerance now existing by the application of modern washing methods. Well sprayed orchards bordering plantings in which successful control has not been obtained present a further complication and it will be necessary in such cases to make additional heavy applications to at least five rows bordering the heavily infested orchard in order to protect the rest of the planting from the build-up resulting from the immigration of moths. Such applications should be as numerous, as heavy and continued, and as late in the season as is necessary to assure the grower of complete protection. This is very important to growers who must contend with this condition.

QUESTION: What else was in the nicotine bentonite?

MR. MARSHALL: Skimmed milk powder, Black Leaf 40, and bentonite.

PROFESSOR BURKHOLDER: How much nicotine was in it?

MR. MARSHALL: I used 4½ pounds of bentonite, 1 pint Black Leaf 40, ¼ pound dry skimmed milk, and it was possible to use some of the mild sulfurs.

PROFESSOR BURKHOLDER: Was calcium used all the way through?

MR. MARSHALL: Yes.

QUESTION: Did you use three or four pounds of lead?

MR. MARSHALL: Four pounds in most cases.

QUESTION: What about the check?

MR. MARSHALL: I used 3 pounds lead and 3 pounds lime.

MEREDITH REED: On your plots you don't use any so-called buffer in your materials.

MR. MARSHALL: I have used the treatment of lead, oil and soap for three years without a buffer.

MERLE TROTH: In your 1936 chart, in every case where you used

summer oil in combination with various arsenicals, with the exception of calcium, you got 23.5 stings per hundred apples or less; in calcium it doubles. Why is that?

MR. MARSHALL: We all know that calcium arsenate is not as efficient as lead arsenate.

HOMER COFFING: I am sure we got a lot of valuable information from that talk on the codling moth.

Mr. Sazama will present a paper at this time on the codling moth investigations during the past year at the Vincennes laboratory.

CODLING MOTH INVESTIGATIONS DURING 1936 AT THE VINCENNES LABORATORY

By L. F. STEINER, R. F. SAZAMA, A. J. ACKERMAN, and S. A. SUMMERLAND, U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine

During the past several years the Bureau of Entomology and Plant Quarantine Laboratory at Vincennes, Indiana, has confined its research entirely to the codling moth and its related problem, spray residue. Its primary function is to develop and improve codling moth control measures which are applicable to the middle-west.

Since 1934 the problem has been approached from two angles, entomological and chemical. It is our purpose in this discussion to outline the entomological investigations conducted during the past season by the Division of Fruit Insect Investigations and to present those findings which are believed to be of most interest to the fruit growers. The chemical investigations will be reported separately by Mr. J. E. Fahey of the Division of Insecticide Investigations.

Insecticide Experiments

Spraying is by no means the only method of suppressing the codling moth, but it remains our most important, and with few exceptions, our final defense against the insect. Likewise, lead arsenate, though not the only insecticide which may be used, remains the only material that can be generally recommended. Other materials of much greater toxicity have been found and are practical for use under certain conditions, but all have rather serious faults, which remain to be considered. However, it has become increasingly apparent as our orchard plantings grow older and larger, that lead arsenate will have to be replaced, not only because of the residue problem from the standpoint of public health, but also because arsenic is toxic to the tree itself and the quantity needed for effective control has under certain conditions, in some sections at least, reached the maximum that the tree can withstand. Obviously under such conditions it is necessary that the grower turn to certain supplementary control measures for assistance until effective substitutes for lead arsenate are developed.

Hundreds of combinations of new materials have been tested under

laboratory conditions and from these the most promising have been taken to the orchard and applied to plots of varying size with an up-to-date spray outfit.

The relative efficiency of each treatment is then determined at least once before and after each spray application by taking an adequate and representative sample of fruit from the orchard to the laboratory where it is exposed to attack by 640 newly hatched larvae. In the course of the 1936 tests where more than 20 treatments were tested we used 235,000 newly hatched larvae to determine their effectiveness. Such data, acquired in conjunction with deposit analyses, made it possible for us to ascertain the effects of growth, rainfall, and temperature on efficiency of a treatment, as well as the relation between deposit and efficiency and it showed those periods during the season when each treatment was least, as well as most, effective. It failed to measure the kill of eggs and it did not include the effect of foliage deposits on the newly hatched larvae. It gave, however, a safe measure of the effectiveness of the materials in question when exposed to attack under the most favorable conditions. In other words, it illustrated the degree of protection the spray deposit would give against larvae hatching under the most favorable weather conditions from eggs deposited on the surface of the fruit. It also made possible a direct comparison of different treatments.

The control data are expressed as larvicidal efficiency. These percentages represent the proportion of kill obtained by the poison itself, and eliminate the mortality which may occur from other factors such as rain, heat or cold, factors which were very important in early 1935. For example, in a certain orchard under observation only one worm in thirty could enter even unsprayed fruit, and under such conditions lead arsenate appeared highly effective. In 1936 conditions were especially favorable and even heavy deposits of lead arsenate failed to prevent the build-up from what had been the lowest to what is now one of the largest over-wintering populations ever observed in southwestern Indiana.

Weather conditions, therefore, affect our efficiency data only as they affect the spray deposit. Obviously these experiments underrate all materials to a certain extent and an efficiency of 85 to 90 per cent in the laboratory, even in a season such as 1936, should approximate perfect control in the field.

Our efforts have been concentrated largely on lead arsenate, nicotine and phenothiazine combinations and schedules. The last named material, phenothiazine, was originally developed by L. E. Smith of the Bureau of Entomology and Plant Quarantine and is an organic compound still entirely in the experimental stage.

The larvicidal efficiencies of eight spray treatments are given in Table I.

Plot 1. Lead arsenate in the 7-day and eight cover sprays again gave comparatively poor results early in the season, although, as in all the plots, these 20-year-old trees were thoroughly wet with from 20 to 25 gallons of solution at each application. It was not until the final cover spray that it gave effective control. It has been demonstrated every year since inauguration of this type of work that lead arsenate

without an effective deposit-builder, when applied at the usual intervals, takes several applications before it begins to kill most of the worms. Usually if spraying is continued through the second half of the season it becomes very effective, but meanwhile it has permitted the entrance of enough larvae in the first-brood period to necessitate late spraying in order to protect the fruit against their progeny. This inevitably results in excess residues at harvest which are difficult, and sometimes impossible, to reduce to the Federal tolerance. At harvest, fruits from this plot which was washed for 20 seconds in an underbrush machine containing 1½% acid at 100° F. barely met the tolerance.

Plot 1-A. Oil-nicotine following the first-brood lead arsenate treatment was slightly inferior to lead arsenate in efficiency against the worms. However, it had a considerable effect on the eggs not shown by these data. Its harvest residue of .055 grains of lead per pound was reduced only to .023 after the washing treatment described under Plot 1. The use of the oil-nicotine following lead arsenate-bordeaux in this instance, therefore, caused more serious residue difficulties than the use of lead arsenate all season.

Plot 2-A. The difficulty experienced each season of catching up with growth where lead arsenate was applied at the usual intervals, together with the difficulty of applying an effective dosage with one application, suggested in 1934 the possibility of concentrating extra sprays around the time of the first hatch. This was our most effective lead arsenate treatment in 1935. In 1936 it was also superior, but to a lesser degree, since the 7-day spray was delayed but four days and only one extra cover was applied.

TABLE I. LARVICIDAL EFFICIENCY OF EXPERIMENTAL SPRAY TREATMENTS, VINCENNES, INDIANA, 1936

640 larvae each test — Variety: Jonathan — Orchard: J. N. Dyer.

Date	May			June					July						August				Grs. lead per lb. fruit at harvest
	22	27	29	4	6	15	17	25	30	2	7	14	16	28	30	11	13	20	31	
Cover spray*		2		3		4			5			6		7		8				
Plot 1	27	16	43	29	49	49	66	71	41	50	67	61	64	49	60	62	72	80	85	.179
Plot 1-A										52	65	64	59	32	57	41	64	60	59	.055
Plot 2-A†	56	33	51	36	53	60	67	..	49	..	..	59	..	27	..	31	..	..	..	.071
Plot 5	55	43	85	74	86	81	92	93	88	91	88	86	87	78	88	83	91	87	83	
Plot 5-A										70	60	61	77	38	49	53	70	77	76	.177
Plot 5-B										89	89	88	87	77	83	74	77	78	72	
Plot 8	74	54	93	58	90	78	96	..	62	95	82	52	84	34	84	55	85	86	78	
Plot 8-A										67	69	52	61	35	49	51	67	79	71	.165
Rainfall between dates (in.)	0		0	1.24	0	.14	0	.34	0	.19	1.01	.52	.09	1.66	0	1.73	0	.10	.09	

Treatments (per 100 Gals.)

Plot 1 —Lead arsenate 3 lbs., Flotation sulphur—7 day; LA 3 lb., Bordeaux ¾-1½-100 in 8 cover sprays.
Plot 1-A—Same as No. 1 until 5th cover spray. Summer oil ½%, nicotine sulphate 1 pt. in last 4 cover sprays.
Plot 2-A—LA 3 lb., Bordeaux ¾-1½-100 on May 15, 19, 22, 28, June 5 and 16. No sprays after June 16.
Plot 5 —Nicotine sulphate 1 pt., Wyoming bentonite 5 lbs., soybean oil 1 qt., Sodium lauryl sulphate ½ oz. Nicotine sulphate and bentonite reduced one-half in last 4 cover sprays.
Plot 5-A—Same as No. 5 until 5th cover spray. Same as No. 1 in last 4 sprays.
Plot 5-B—Same as No. 5 until 5th cover spray. Summer oil ½%, nicotine sulphate 1 pt. in last 4 sprays.
Plot 8 —Phenothiazine 4 lbs. 8 cover sprays.
Plot 8-A—Same as No 8 until 5th cover spray. Same as No. 1 in last 4 sprays.

*Extra sprays applied to 2-A on May 15 to 22. First cover to all plots—May 19. 7-day, Plot 1 May 11.
†Larvicidal efficiency of 2-A before spray on May 22 was 38 per cent.

Plot 5. The combination of a commercial preparation of sodium lauryl sulphate, nicotine sulphate, Wyoming bentonite and soybean oil, added to a partially filled spray tank of water in the order named was developed in laboratory tests in 1934 and 1935 and was the outstanding treatment in our 1935 field tests. In 1936 it again appeared superior to all others despite a reduction of 50 per cent in the nicotine and bentonite content after June 16. It has been noted in our insecticide tests, particularly during the past three years, that certain organic insecticides such as nicotine-bentonite and phenothiazine are much more effective during the first-brood period than lead arsenate. Usually lead arsenate during the period of heavy attack late in August, however, equalled them, because an effective load had finally been built up. It will be noted that on May 22, Plot 5, which had received one application of the nicotine-bentonite mixture three days earlier, was equal to three applications of lead arsenate (Plot 2-A) applied during the preceding eight days. It was not until late August that lead arsenate again equalled the nicotine-bentonite treatment, the differences on August 20 and 31 being too small to be considered significant. Plot 5 reached a very high efficiency after the second application and remained so uniformly high throughout the season that successive applications of spray material could not force it much higher, even though analyses showed that comparatively large deposits of nicotine were being put on. The larvicidal efficiency of this combination was relatively unaffected by growth, probably because of the excess deposit, nor was it influenced by rainfall or the extreme high temperatures in late June, early July and late August. This treatment left a more conspicuous deposit at harvest than two commercial nicotine-bentonites tested, but the latter lost too much of their effectiveness between sprays, although they remained superior to lead arsenate. The conspicuous deposits left by this treatment may in some seasons affect the coloration of red varieties. It can be removed by a weak alkali wash in a brush machine.

Plot 5-A. The nicotine-bentonite treatment cannot be used with bordeaux and partly for this reason, lead arsenate-bordeaux was substituted on a part of the plot during the period when certain disease applications would normally be made. The application of bordeaux-lead almost immediately reduced the efficiency of the nicotine-bentonite to the level of lead arsenate. The harvest load of .177 grains of lead per pound was reduced to .009 by the washing treatment described above.

Plot 5-B. In order to avoid the necessity for washing the bentonite residue from the Plot 5 treatment at harvest, oil-nicotine was applied in the four last sprays in this plot. This fruit was in excellent condition at harvest, and no residue could be seen. The most striking result was the maintenance of the larvicidal efficiency at almost the same level as the Plot 5 treatment until after the seventh cover spray, while oil-nicotine following lead-bordeaux (Plot 1-A) was very much inferior.

All nicotine combinations gave excellent control of leaf hoppers, a very serious pest this season.

Plot 8. Phenothiazine has a remarkably high toxicity to codling moth. In laboratory work one-fourth pound in 100 gallons is very much

superior to two pounds of lead arsenate. However, under field conditions we have not yet been able to find a suitable sticker. Reference to Table I will illustrate the susceptibility to weathering, the drop between sprays being tremendous, especially following rains. This is less marked early in the season when some pubescence remains on the fruit. For this reason and because the material causes a deepening of the green ground color of fruit at harvest, the possibility of using it against the first-brood and following it with lead arsenate, was tested.

Plot 8-A. When lead arsenate was substituted for phenothiazine, the high efficiency of the latter material soon disappeared, and this plot dropped to the level of lead arsenate. Removal of the residue at harvest was no more difficult than for Plot 5-A. Inasmuch as the effect on color disappeared by harvest, this treatment is promising.

Although several adhesives for phenothiazine were tested, nothing satisfactory was found. The material was ineffective against leaf hoppers and the apple leak skeletonizer. Neither it nor the nicotine combinations caused any injury to fruit or foliage other than noted above, while all plots receiving lead arsenate showed considerable lead spotting, marginal burn and subsequent leaf drop.

No recommendations can be made concerning the use of these organic materials until they have been adequately tested on a large scale. A part of our data is presented here merely to show that the outlook for the successful development of effective lead arsenate substitutes is not at all discouraging.

The use of lead arsenate late in the season, and the more toxic organic materials earlier when growth is so rapid, has, to our knowledge, not been previously tested. The current tests indicate that residue removal is much simplified by such an arrangement. Little mention has been made of disease control. We believe, however, that apple-scab can be adequately controlled before codling moth cover sprays are applied if your Experiment Station's recommendations are carefully followed.

Orchard Sanitation

For the third successive year, clean-up and banding operations were conducted in a 40-acre, 32-year-old orchard at Elberfeld, Indiana. The same 20-acre half of the orchard has been used each season, but in 1936 the complete removal of ground debris was confined to only eight acres, while the entire 20 was again scraped and banded with both trunk and scaffold-limb beta-naphthol bands. Both the cleaned and uncleaned sections were sprayed alike by the grower early in the season, but the tremendous codling moth build-up caused him to give up spraying. Early in September this fruit carried a lead load of only .027 grains per pound which, on the basis of our tests with lead arsenate, indicates that little or no control was being effected by the sprays applied during the season.

Labor used for the 1936 clean-up was divided as follows:

Operations	Number Trees	Number Hours	Ave. Time Per Tree
Bark scraping	452	330	0.73 hours
Raking debris	172	144	0.84 hours
Hauling debris	172	46	0.27 hours
Sealing shed	.....	6	.....

In 1934 and 1935 the early destruction of ground debris apparently reduced the injury by the apple flea weevil so that the cleaned area produced 59 and 19 per cent more fruit respectively. The trees in the check area were damaged so severely in 1935 that bud development for 1936 was apparently affected, with the result that in the scraped and banded section the crop averaged 52 per cent greater than in the check area. The apple flea weevil was well controlled by a single application of flotation sulphur cryolite in the "pink" period.

In 1934 the operations resulted in an average reduction in worms per 100 apples of 41.9 per cent. Because of the larger crop the worm population per tree was reduced only 13.6 per cent. In 1935 the average reduction in injuries per 100 apples was 57 per cent and in injuries per tree 45 per cent, thus some cumulative benefit was shown.

In 1936, however, there was an increase of 18 per cent per tree in the average worm population (number worm entrances) for the scraped and banded section and of 103 per cent in the area where the ground clean-up was also conducted. The decrease in worm entrances per 100 apples for these two areas was 22 per cent and 44 per cent respectively. The infestation figures were as follows:

	Apples	Worms Per Tree	Worms Per 100 Apples
Check area	912	2,461	270
A—Scraped and banded	1,379	2,903	211
B—Scraped, banded, ground clean-up	3,282	4,985	152

The size of the crop has an important bearing on infestation. The number of worms per tree tends to vary in direct proportion as the size of the crop varies while the number of worms per 100 apples tends to vary in inverse proportion, or to decrease as the number of apples increase. The results, therefore, are approximately what would be expected had no treatment been applied to either area. The results, however, by no means indicate that orchard sanitation is not beneficial. To obtain the greatest return from any one control measure the population must, of course, remain within reasonable limits, and the early discontinuance of spraying prevented a fair test.

This experiment illustrates the interdependence of various control measures. For example, worm attack in the check area had been so severe by early September that only one-eighth as many apples remained on the trees as in the cleaned, scraped and banded block. In the two treated areas, A and B, 81 and 66 per cent respectively, of the crop had fallen largely as a result of worm attack. In the check area 86.4 per cent of the light crop had fallen, leaving an average crop of only 125 apples per tree. Many trees had lost practically every apple. It is believed that this great reduction and absence of fruit in the check area at a time when activity was very great, stimulated a large movement of moths into the cleaned areas. At any rate, a much larger quantity as well as a larger proportion of the crop in the cleaned area hung on and was subject to repeated attacks by late third-brood and early fourth-brood larvae. Had other control measures, including spray-

ing, been effective enough to reduce the worm attack, it is possible that enough apples would have remained in the check area to help hold the population originally produced there.

Before the 1936 scraping and clean-up was begun, a thorough examination requiring about 11 working days was made of six trees and samples of the ground underneath. Every possible cocooning place was inspected. The trees included three in each area. They had been used as record trees in 1935.

Weed stems from earlier than 1935 growth, and bits of wood were the preferred quarters on the ground in the uncleaned area. Although there were many weeds in the cleaned area, they had all grown up in 1935 and did not contain larvae. In 1935 a total of 4,511 larvae entered fruit on the three trees in the cleaned area. A total of 597 were caught in the bands; yet only 56 cocoons containing 10 living larvae remained on and under these trees in April of 1936. Half of the 10 were on the trees and half on the ground. The latter were spun-up on exposed roots.

In the uncleaned area 66 survived out of a total production of 8,600. These also were divided half and half between tree and ground. The many larvae which were unaccounted for were probably carried out with the crop, or in one of the five crop pick-ups, or destroyed by natural enemies and other means.

Survival in the cleaned area was at the rate of only one out of 450 while in the uncleaned area it was one out of 130, indicating that bands and the removal of suitable cocooning quarters on the ground made survival more difficult. Above all, these figures show the tremendous influence that weather conditions have on fluctuations in codling moth abundance. In 1936 the three trees in the cleaned area which had had a survival of only 10 larvae produced a crop of 7,604 apples injured by 13,578 successful worm entrances. The three bands captured 1,528 larvae. It is obvious from the above that the codling moth's reproductive capacity is remarkable under favorable conditions.

Bait Trap Experiments

More than 48,000 moths were captured during 1936 in 338 baited trees at Vincennes and Bicknell.

The value of bait traps as a means of timing sprays has been discussed on numerous occasions. Their value as a supplementary means of control is still undetermined, but they offer sufficient promise to justify intensive research. Our greatest need is for a bait solution of uniformly high attractiveness which can be easily prepared and duplicated. In our tests of numerous attractive agents during the past three years we have found as most effective a 10 per cent solution of dark brown sugar (No. 13) to which has been added either oil of sassafras, bromo styrol or oil of mace. The aromatic materials were used at the rate of one-half cubic centimeter per quart of solution or approximately 1 pint per 225 gallons. Oil of sassafras is obtainable in either natural or synthetic form. The former has been much more attractive. Molasses, where substituted for dark brown sugar, has proved less attractive in this area.

Where used as a means of timing sprays, bait solutions should be maintained in alternate traps at two ages and completely renewed at two-week intervals in hot, dry weather and three- to four-week intervals if cool and rainy weather prevails. Two ages are needed to insure a more uniform degree of attractiveness and to avoid the occurrence of artificially induced peak catches caused by high points in the attractiveness of the bait. A trap consisting of two wide mouth fruit jars joined at the neck by a flexible connection so that either can be emptied independently of the other was developed at Vincennes and has been used in most experiments since 1934. Bait solutions of two ages can thus be readily used in the same trap.

In 1935 and 1936 a 7-acre 10 x 20 tree block in the baited area at Bicknell was scraped and banded with trunk bands the first season and with both trunk and scaffold limb bands in 1936. The bands were treated with beta-naphthol. This area was trapped with a mixture of experimental bait solutions.

In 1935 the check area averaged 3,250 apples and 474 worms per tree, and the treated area 3,940 apples and 151 worms per tree, or a reduction of 68 per cent. The preceding year there was a difference in the same direction of 20 per cent when both areas had been treated alike, leaving a net reduction in 1935 of about 50 per cent.

In 1936 the treated area produced a lighter crop, the average being 2,695 apples per tree as compared to 6,510 for the check area. The number of worms per tree was reduced 61 per cent from 11,432 to 4,394. Worm entrances per 100 apples were only 7.9 per cent less and total injuries 20.6 per cent less in the treated areas. Analyses of lead residue in September showed a deposit of .10 grains per pound for the treated and .12 for the check area.

Effect of Seasonal Conditions

Attention has been called to the strong come-back made by the codling moth during the past season. Not since the establishment of the Vincennes laboratory has the insect demonstrated so conclusively as it did in 1935 and in 1936 the importance played by weather in regulating its abundance. After being suppressed by unfavorable weather to a very low level in 1935 it came back in 1936 to cause serious damage all over this section of the middle west. Dusk and dawn temperatures on most days in May and June were favorable for oviposition, rains were infrequent and of short duration, and daily temperatures averaged high enough to bring development along at nearly top speed. Only 39 days elapsed between the peaks of first and second-brood moth abundance in July and August respectively.

The following statement made by us before this organization at the annual meeting a year ago will bear repetition:

"Failure to appreciate fully the effects of weather on the vitality and abundance of codling moth larvae and an inclination to give too much credit to spray applications may lead to difficulties. The codling moth has demonstrated repeatedly its remarkable recuperative powers and its ability, if given favorable weather conditions, to come back in one season's time despite intensive efforts to hold it in check. Because

we cannot yet make long-distance forecasts of weather and because time and repeated applications are necessary to build up a sufficient protective deposit of spray material and keep pace with growth, intensive efforts, before we know how abundant the insect will become, are essential."

Not only because of the low prices in 1935, and the prospects for a poor crop in 1936, but also because the codling moth appeared whipped, many Indiana growers failed to scrape their trees last winter, thinking that banding would be unnecessary. Less attention was paid to packing house and orchard sanitation. Likewise, in too many instances the recommendations for intensive spraying in preparation for the first hatch was not appreciated until too late, or after the rapidly increasing population made it apparent that the codling moth was on the way back. Some of those growers who did not let up in their control program and whose orchards were isolated against reinfestation from outside obtained good control despite the season.

Summary and Conclusions

The two very dissimilar seasons of 1935 and 1936 illustrated the great influence that weather conditions have on codling moth abundance. The insect decreased in abundance in 1935 as a result of a cool, rainy spring and came through the severe winter of 1935-36 with an extremely light population. Under very favorable spring and summer conditions in 1936 it increased at a remarkable rate until by harvest it had built up a population of record size for this area.

This ability of the insect to recuperate in one season must be fully recognized by the fruit grower and his control program adjusted accordingly if he is to avoid serious losses in seasons when weather conditions are favorable. Until we can successfully forecast seasonal conditions the safest and most economical course is to start the control program with the expectation that a heavy attack is ahead. Any added suppression of the population level that may be effected in seasons when weather conditions make control easy will be of benefit in later seasons such as 1936, particularly if the orchard is isolated enough to prevent reinfestation from more heavily infested areas. Proximity to more heavily infested orchards, however, may partially offset the effects of control measures and tend to eliminate any cumulative effect because of inter-orchard movement of moths.

Although lead arsenate remains the most satisfactory all around codling moth insecticide, investigations indicate that it is not generally used in the most effective manner. It requires a very heavy deposit for adequate protection, and early season sprays are usually spaced too far apart to obtain an effective deposit until the rate of growth has diminished and the first-brood attack is over. Obviously, thorough spraying, and the build-up of an effective deposit before hatching begins, is essential. This is particularly important because it is largely the progeny of the first worms to enter which constitute the very destructive third-brood in this area. Furthermore, failure to control the first-brood will necessitate the application of late sprays and result in serious resi-

due removal difficulties. Since the tree also has a limited tolerance for arsenic it is essential that the poison be most efficiently used and the need for excessive deposits later in the season avoided.

Certain very toxic organic materials and spray combinations have been developed in combination laboratory and field experiments to a point where they are ready for more extensive field tests. These materials give promise of being superior to lead arsenate, but because of incompatability with certain fungicides they will not fit into all spray programs.

Complete removal of rough bark by scraping, in conjunction with the removal of ground debris and the use of beta-naphthol bands gave an apparent reduction of 50 per cent in the codling moth attack after two years in half of a 40-acre orchard. In 1936, the third year of the test, cessation of spraying in July and a light crop in the uncleaned area resulted in such a heavy attack that most of the fruit dropped before harvest. A fair crop in the cleaned area experienced such a heavy late attack, apparently as a result of migration from the untreated block, that no control could be shown at harvest. This experiment demonstrates the need for complete and large scale efforts. Examinations in the two areas to determine the effects of the 1935 sanitative operations on the rate of survival proved that it was far more difficult for worms to find suitable quarters and survive in the cleaned areas. There, only one worm out of approximately every 450 produced, survived until the end of last winter while, in the uncleaned area, one out of approximately every 130 remained alive. Half of those which survived had hibernated in weed stems, bits of wood, and exposed roots. Many of the worms produced in each area had, of course, been carried out of the orchard with the crop, and many have hibernated successfully elsewhere. The return of some of these as moths was prevented by sealing the packing sheds.

For use in timing sprays a 10 per cent dark brown sugar bait containing natural oil of sassafras at about 15 drops per quart has proven very satisfactory. Two or more ages of this bait should be maintained in several traps.

After this very interesting and excellently prepared report a brief discussion followed and Mr. Coffing introduced Mr. Fahey, who presented a paper dealing with the chemical aspects of various spray deposits.

CHEMICAL STUDIES OF SPRAY DEPOSITS

By J. E. Fahey and H. W. Rusk, Division of Insecticide Investigations, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture

All orchardists are more or less familiar with the effects of growth and weather on spray deposits. They know that as the surface area increases the spray deposit is thinned and that rains and the continual brushing by moving foliage removes residue from the fruit. It is the purpose of this paper to show the general effects of growth and weather

on spray deposits, with particular reference to the general types of spray treatments used in Indiana. The harvest time residues from several spray schedules will be discussed.

During the growing seasons of 1935 and 1936 we have had nearly ideal conditions for studying the effects of growth and weather on spray deposits. Except for minor changes our standard lead arsenate plot was the same in both years. Weather, as measured by precipitation, varied between near-flood conditions in 1935 and the extremes of drought in 1936. The average daily rainfall during the 1935 growing season was 0.173 inch, or 0.046 inch above normal; whereas in 1936 the daily average rainfall was 0.076 inch or 0.051 inch below normal. In 1936 very little fruit was set on the plots which had been used during 1935, which forced a change in variety of trees used in experimental plots, and this may account for some of the differences in residue load obtained during these two seasons.

In order to simplify the data presented, only the lead residues from the lead arsenate deposits are given. The arsenious oxide residue would approximate one-half of the lead residue. It would be theoretically possible for the ratio of lead to arsenious oxide in a lead arsenate deposit to vary from 2.09:1 to 3.5:1. In nearly 800 lead and arsenic determinations, however, made on lead arsenate deposits at the Vincennes labora-

TABLE I. FRUIT GROWTH AND RESIDUE LOAD

Date	Days from Full Bloom	Area Per Fruit	Increase in Area		Residue* Deposited Per Fruit	Residue Load Per Sq. Cm.	
			Between Dates	Daily Average		Before	After
			Per Cent	Per Cent	Micrograms	Micrograms	Micrograms
1935, Grimes, 8 Sprays							
May 9	7	2.47	.....	.....	100.0	.....	40.5
May 22	20	10.26	315	24.2	120.0	9.7	21.4
June 4	33	23.72	131	10.1	150.0	9.3	15.6
June 17	46	38.19	61	4.7	350.0	9.7	18.9
June 28	57	47.63	25	2.3	600.0	15.1	27.7
July 15	74	71.73	51	3.0	700.0	18.4	28.2
July 29	88	85.76	20	1.4	800.0	23.6	32.9
Aug. 12	102	96.41	12	0.9	1000.0	29.3	39.6
Sept. 10	131	131.16	36	1.2	.....	29.1	.....
1936, Jonathan, 9 Sprays							
May 11	7	4.74	.....	.....	100.0	.....	21.1
May 19	15	11.08	134	16.8	120.0	9.0	19.9
May 27	23	19.75	78	9.8	150.0	11.1	18.7
June 4	31	24.88	26	3.2	350.0	14.9	28.9
June 15	42	37.61	51	4.6	400.0	19.1	29.8
June 30	57	54.30	44	2.9	600.0	20.6	31.7
July 14	71	67.13	24	1.7	700.0	25.6	36.0
July 28	85	85.47	27	1.9	800.0	28.3	37.7
Aug. 11	99	100.04	17	1.2	1000.0	32.2	42.2
Aug. 31	119	113.84	14	0.7	.....	37.1	.....

*Hypothetical figures used for calculations, see text.

tory during the last two years the ratio of lead to arsenious oxide has averaged 2.13:1. The maximum ratio obtained during these two years was 2.8:1.

Fruit Growth and Spray Residue

The effect of fruit growth on spray deposit can be shown by calculations from the records. Fruit-growth data of the 1935 and 1936 seasons are shown in Table I, with calculations of their effect on hypothetical spray deposits. To determine the area of individual fruits, the average weight and specific gravity were determined for a representative sample, and the area was then calculated assuming the fruit to be a sphere. The spray-residue figures shown in Table I were not obtained from actual analyses of fruit samples, but are approximations of the lead residues deposited by corresponding sprays in our studies of 1936. The purpose of these data is to show the effect of growth at different periods during the growing season. During May and the first part of June the rate of increase in area may be as much as 24 per cent per day, thus reducing the spray residue per unit area one-fifth each day. After the middle of June there is a gradual decrease in the per cent increase in area per day. Thus fruit growth directly opposes the efforts of the orchardist, for when he wishes to build up a heavy residue to protect the fruit, growth is most active in thinning the coverage, and when it is desired to decrease the residue load to assist in residue removal, growth is the least active in thinning the spray deposit.

Weather and Spray Residue

In considering the effect of weather on spray residues it is desirable to disregard the effect of growth. In Table II data are presented showing the spray residue deposit in micrograms per fruit at intervals during the growing season of 1935 and 1936. These data are taken from our standard lead arsenate-bordeaux plot. Four pounds of lead arsenate to 100 gallons were used in the first two sprays of 1935 and three pounds of lead arsenate to 100 gallons in the remaining five sprays, whereas in 1936 only three pounds of lead arsenate to 100 gallons were used in all (eight) spray applications. Bordeaux at ¾-1½-100 was used in all sprays both seasons. In 1935 the experiment was on Grimes and in 1936 on Jonathan fruit. From these data it appears that rainfall is not a very reliable criterion of the weathering of spray residues, for although the rainfall in 1935 was nearly twice as great as the rainfall in 1936 the residue lost by weathering during these two seasons was 59.6 and 53.0 per cent, respectively. Extreme heat, wind, and other elements are apparently as effective in removing residues as rainfall.

In Table II only one type of spray residue was considered, that from lead arsenate-bordeaux sprays. In Table III the effect of weather on three types of spray residues is shown. The lead arsenate-bordeaux plot for both 1935 and 1936 is repeated from Table II, and in addition data are shown from one plot receiving four lead-oil-soap sprays followed by lead arsenate-bordeaux and from one plot receiving lead-oil-lime sprays throughout the season. Except for the one lead arsenate-bordeaux plot all of these data were taken from our 1935 sprays on Grimes fruit.

These data show that the addition of oil to the spray mixture produces a greater residue deposit and that such residues resist weathering better than the lead arsenate-bordeaux residue.

TABLE II. WEATHERING OF LEAD ARSENATE-BORDEAUX RESIDUES

1935, Grimes Fruit, 7 Sprays					1936, Jonathan Fruit, 9 Sprays				
Date	Rainfall Between Sprays	Lead Residue Deposit			Date	Rainfall Between Sprays	Lead Residue Deposit		
		Per Fruit	Gained by Spray	Loss from Weather			Per Fruit	Gained by Spray	Loss from Weather
	Inches	Micrograms	Micrograms	Micrograms		Inches	Micrograms	Micrograms	Micrograms
					May 11		120.0	120.0	
					May 19		196.2	76.2	
May 22		360.8	360.8		May 22	.14	122.4		73.8
					May 29		354.0	231.6	
June 3	1.45	232.1		128.7	June 4	1.24	217.3		136.7
June 3		827.6	595.5		June 6		585.0	367.7	
June 17	3.60	485.7		341.9	June 15	.14	550.2		34.8
June 18	1.15	943.3	457.6		June 17		997.6	447.4	
June 27	.55	939.0		4.3	June 30	.34	1052.4	54.8*	
June 28		1566.6	627.6		July 2	.19	1628.0	575.6	
July 17	1.90	1319.7		246.9	July 14	1.62	1200.0		428.0
July 18		2299.8	980.1		July 16		1990.0	790.0	
July 29	.72	1898.8		401.0	July 28	1.66	1569.8		420.2
July 31		3220.6	1321.8		July 29		2318.8	749.0	
Aug. 12	2.90	2885.0		335.6	Aug. 11	1.73	2134.0		184.8
Aug. 16	1.02	4066.2	1181.2		Aug. 13		3124.0	990.0	
Sept. 10	2.07	2232.2		1834.0	Aug. 31	.19	2067.9		1056.1
Total	15.36		5524.6	3292.4	Total	7.25		4402.3	2334.4
Residue lost by weathering, 59.6 per cent.					Residue lost by weathering, 53.0 per cent				

*This deposit was not from any additional spraying but an unexplained gain between spray applications; therefore it is added to residue gained by spray.

TABLE III. LEAD RESIDUES IN MICROGRAMS PER FRUIT FROM LEAD ARSENATE AFTER WEATHERING OF SPRAY DEPOSITS

Spray Treatment	Total Residue Deposited by All Sprays	Residue at Harvest	Residue Lost During Season	Total Residue Lost by Weather	Total Residue Remaining at Harvest
				Per Cent	Per Cent
Lead arsenate-bordeaux, 7 sprays 1935, Grimes fruit	5,524.6	2,232.2	3,292.4	59.6	40.4
Lead arsenate-bordeaux, 9 sprays 1936, Jonathan fruit	4,402.3	2,067.9	2,334.4	53.0	47.0
Lead arsenate-oil-lime, 7 sprays 1935, Grimes fruit	7,398.5	3,348.8	4,049.7	54.7	45.3
Lead arsenate-oil-soap, 4 sprays; Lead arsenate-bordeaux, 5 sprays 1935, Grimes fruit	6,656.5	3,785.5	2,871.5	43.1	56.9

Harvest Residues

No discussion of spray residue would be complete without reference to the harvest-residue load. In Table IV, 16 experimental spray schedules are outlined, with the resulting residues at harvest and a classification of the ease with which these residues can be removed. Where lead arsenate was used in all sprays the residue ranged from 0.10 to 0.36

grain per pound of fruit at harvest. The use of adhesives or an increased number of sprays increased the residue load. The removal of residues from spray mixtures containing adhesives is difficult, and although the residue load can be materially reduced by decreasing the number of spray applications, the ease with which these residues can be removed is not affected.

When lead arsenate was used only in the first-brood sprays, the residue load at harvest was materially reduced. When no adhesive was used with or following first-brood sprays of lead arsenate, the residue removal was correspondingly easy. However, when adhesives were used with or following lead arsenate, the residue removal was difficult.

Lead arsenate used only in second-brood sprays deposited a very heavy residue load for the number of sprays applied. One final cover spray of lead arsenate will deposit a residue load equal to that deposited by four first-brood cover sprays of the same material. Residues deposited by second-brood cover sprays are relatively easy to remove when no adhesive is used.

Summary

Fruit growth is so rapid early in the season that residues per unit area may be decreased as much as 20 per cent per day, but between the final cover spray and harvest the decrease is less than 1 per cent per day.

TABLE IV. SPRAY SCHEDULES AND HARVEST RESIDUE LOAD

Spray Schedule	Season*	Sprays Per Brood		Grains Lead Per Pound at Harvest	Residue Removal†
		First	Second		
		Number	Number		
Lead arsenate in all sprays:					
Lead arsenate-bordeaux	1935	4	3	0.200	Good
	1935	4	1	.103	Good
	1936	4	4	.179	Medium
Lead arsenate-oil-lime	1936	6	4	.198	Medium
	1935	4	3	.364	Poor
	1935	4	1	.149	Poor
Lead arsenate-oil-soap 4 sprays followed by lead arsenate-bordeaux	1935	6	3	.344	Poor
	1935	6	1	.174	Fair
Lead arsenate-bordeaux-kerosene-triethanolamine oleate, first-brood followed by lead arsenate-bordeaux	1936	4	4	.219	Medium
Lead arsenate in first-brood sprays only:					
Lead arsenate-bordeaux	1936	6		.071	Good
Lead arsenate-bordeaux followed by nicotine-oil	1936	4	4	.055	Poor
Lead arsenate-bordeaux followed by nicotine-peat	1936	4	4	.049	Excellent
Lead arsenate-oil-lime followed by phenothiazine-soap	1935	4	3	.131	Poor
Lead arsenate in second-brood sprays:					
Nicotine-bentonite first brood followed by lead arsenate-bordeaux	1936	4	4	.177	Excellent
Phenothiazine first-brood followed by lead arsenate-bordeaux	1936	4	4	.165	Excellent
Phenothiazine first 7 sprays, with final spray of lead arsenate	1936	4	3-1	.061	Excellent

*1935 spray treatments on Grimes fruit, 1936 spray treatments on Jonathan fruit.
†Residue removal.
Excellent: Cleaned to 0.014 grain of lead per pound by cold acid—1.5 per cent.
Good: Cleaned to 0.018 grain of lead per pound by cold acid—1.5 per cent.
Medium: Cleaned to 0.018 grain of lead per pound by hot acid—1.5 per cent.
Fair: Cleaned to 0.018 grain of lead per pound by hot acid—1.5 per cent, plus wetting agent ¼ per cent.
Poor: Not cleaned to 0.018 grain of lead per pound by above treatments.

Weathering removes from 40 to 60 per cent of all spray deposited, depending upon the type of residue.

Factors of weathering other than rainfall are largely responsible for reduction of residue loads.

Adhesives used with or following lead arsenate sprays complicate spray-residue removal.

Second-brood sprays are responsible for most of the harvest-residue load. These residues are relatively easy to remove, however, provided no adhesive is used in the spray mixture.

HOMER COFFING: Thank you, Mr. Fahey, for your interesting paper. With the continued residue tolerances, the problem of spray residue is one that we must all watch closely. This makes it all the more important that we follow a thorough early season spray program.

Professor Burkholder, do you want to compare that spray schedule now with the one of last year?

PROFESSOR BURKHOLDER: I would prefer to do it this afternoon.

HOMER COFFING: Our last speaker we had scheduled was David Simpson, but he is unavoidably absent with sickness in the family. I'm sorry we didn"t get to hear him, but our morning is about gone now, and I guess we're ready for adjournment if there isn't anything further to be brought up at this time. I feel that we've had a good meeting and I hope all of you have a successful fruit year.

(Adjournment)

Thursday Afternoon

Professor Burkholder continued the meeting unofficially with a brief spray conference with a number of the interested men who remained.

Articles from Hoosier Horticulture

THAT QUESTION OF POLLEN

By

R. C. SIMPSON, Vincennes

What orchardist has not realized fifteen years too late, that some block, or even an entire orchard, has a pollination problem,—blocks which will never set well unless some radical change is made. It is tragedy indeed to watch a section of bearing age trees, beautiful with bloom year after year, and gradually realize that these trees will never bear profitably. Each year one feels surely they will set fruit this time. Surely the years of careful and expensive care will be rewarded!

There are several causes of unsuccessful or unsatisfactory set.

1. The trees may be slow coming into bearing simply because the blooms have not been produced by the tree.

2. Natural environment may delay trees coming into bearing, as improper soil and moisture conditions, frost pockets, etc., even though the trees bloom well and are provided with pollenizers.

3. New varieties intended as pollenizers may later be found to lack fertile pollen.

4. Intended pollenizers may be strongly alternate bearers.

5. Blooming dates of pollenizers may not overlap sufficiently to permit satisfactory pollination.

6. Pollenizers may be too few or too far away.

There are also numerous other causes for poor sets on certain years, or in certain sections for a given year.

Two examples of a real pollination problem might be mentioned. The one is an orchard which contained 40 acres of solidly planted Akin adjoined by 40 acres of solid Ben Davis. Perhaps there were years when the entire planting bore well. However, on the years in mind, the situation was striking. The three or four rows nearest the adjoining variety were literally breaking with fruit. The next two or three rows set a fair crop. The farther rows had no fruit. The dropping off in yield was marked and rapid beyond those first three or four rows.

In another case an orchard was systematically planted to three different varieties, but all were of the Winesap group. Replanting of pollen varieties has helped this situation, but years are required for a replant to produce bloom in abundance. This orchard has been consistently unproductive, although the trees are mature, in good condition and are carefully pruned and cared for,—just in their prime. In this case remedial measures have been undertaken by proper selection of replant varieties and systematic topworking.

Feeling that some of the methods being used by one grower may be of interest to others, the writer will discuss some methods being used by the Simpson Orchard Company to remedy pollination troubles.

One large block of Transparent was set every fifth row to Duchess and Williams Early Red. Because of soil conditions all Williams soon died out. The Duchess also are going out. The Transparent seem more persistent as few have died. This leaves a definite problem. Our individual tree records show very definitely the beneficial effect of the Duchess on the nearer Transparent rows. As a remedy we have used bees and are topworking pollen varieties onto the Transparent. These should begin to bloom before all Duchess are gone.

In a second block, Jonathan was set with every fourth row either Delicious or Williams Early Red. The rows of Jonathan nearest the Williams row have set noticeably lighter on most years. The only conclusion is that the Williams Early Red bloom so late that most of the Jonathan bloom is gone. We have used bouquets and bees in this case. Fortunately only a few rows are in question here.

A third block is set to Winesap, with every third row alternating Turley, or Rome and Wealthy. As the planting reached bearing age

we learned Turley was an unsatisfactory source of pollen. This left five rows between the pollen varieties where we had intended only two. Six years of individual tree records show very definitely the result of this situation. The Winesap rows nearest the Rome have borne much heavier than the second rows. Fortunately the center row of the five is Turley. Although the Turley set is usually moderate, the size of fruit has more than made up the deficiency. As a result the Turley has borne annually and heavily. Where Winesap form the outside rows of the field the dropping off in yield is even more marked.

As this is one of our most valuable blocks, several remedial measures are being followed. Each year bouquets have been placed in the section setting most poorly. Also some trees have been topworked to Wealthy which variety is also being used as a replant. Bees have been introduced every year at blooming time.

This summarizes briefly our individual pollination problem.

Production determines profits, and pollination is one of the first considerations in production. There are few growers who do not have some sections or rows which set poorly as a result of inefficient pollination. For those who may wish to improve this condition by one or more means, a few of our observations and conclusions may be of interest.

Bouquets

We first tried gallon cans hung in the tree tops, a method that is often suggested. These were most unsatisfactory. The blossoms soon wilted, the total quantity of bloom was necessarily small, the bees did not work in the blossoms as expected, and the installation and removal took too much time.

The following year we used spray barrels and found them much more satisfactory from every standpoint, although we still used branches which were too small. These barrels were set at frequent intervals along the rows, on the southeast side of the tree. The third year the blooming branches used were as long and large as could be obtained. Fortunately the removal of Jonathan and Delicious fillers elsewhere supplied an abundance of bloom. Many large limbs in water actually set fruit. We learned that:

The larger the limb, the more lasting the bloom.

Large bouquets require much water.

Barrels must be kept well filled to prevent being blown over.

Barrels must be clean. Oil may repel the bees.

Dirty water quickly seals the absorbing surface of the branch causing it to wilt.

Bees will not work in wilted or frost killed blooms.

Bees will not work freely where blossoms are closely crowded together.

Large limbs planted in wet soil will wilt nearly as quickly as those out of water.

Bees

One hive per acre is recommended where pollination is a problem.

In cool, windy or unsettled weather bees make short flights so the hives should be placed near trees to be pollenized. This may be a determining factor in very unfavorable years.

Hives should be placed so as to get the morning sun, and be sheltered from cold northwest winds.

Move bees from peaches to apples or from early to late blooming blocks if prolonged cool weather is reducing insect activity and the set is in question.

Remove hives from the orchard before applying lead sprays.

Topworking

Topworking is the quickest permanent remedy for poor pollination.

The variety should require the same sprays as the tree on which it is worked.

A variety which will not be confused at picking time is desirable.

The variety should not be subject to blight.

If possible ascertain probable congeniality of varieties concerned. Much help can be secured from the U.S.D.A. and the State Experiment Stations.

Replanting

In selecting a pollen variety for replanting the following conditions are desirable:

Similar blooming period.
Early bearing.
Abundant fertile pollen.
Annual bearing habit.
Similar spray requirement.
Similar ripening period, if possible.

Distance

Usually more than two rows between pollenizers results in a rapidly decreasing yield as the interval is increased.

Solid pollenizer rows are more economically handled than trees scattered indiscriminately.

Fertilizers

Fall or very early spring nitrating is usually beneficial in increasing set on varieties such as Winesap.

Results and Conclusions

We have brought from fifty to one hundred hives of bees into our orchards for a number of years. Their value was definitely shown in 1935 with peaches. The blooming period was so altered by cool weather that Hale was almost out of bloom before Elberta was well open. Bees were active only a few hours at a time; fifteen minutes on some days, and many days not at all. During these brief periods bees were abundant near the hives, while often very few could be found 100 to 200 feet away. At harvest time there was little difference in yield of Elberta in our two orchards. However, Hale set a fair crop in the

orchard having had bees during the brief and critical period when both Hale and Elberta were in bloom. The other orchard had a very light crop of Hale. This applied to the small second crop Hale (buttons) as well as the main crop. The hives were then moved to the apples for most of the blooming period.

In checking over records of apple trees nearest large bouquets at least 80% seemed to be definitely influenced. The first year barrels were used the weather was very unfavorable. Marked influence extended only to the nearer half of the adjacent trees, although less evident benefit probably extended much farther. These bouquets were distributed along the outer rows of the orchard along the poorest yielding section. For the past two years, with somewhat more favorable weather, the effect of the bouquets appears to have carried much farther.

In our replanting we have used many Turley trees and will use Virginia Crab this year. Our plan is to grow these trees as a framework and five to eight years later topwork them to the variety which appears most promising at that time. Both varieties are vigorous, hardy, and disease resistant; and both form wonderfully strong frameworks.

In concluding, it should be remembered that yield may be the determining factor in profitable production. Lack of sufficient pollination often causes an otherwise valuable variety to remain unproductive. Often growers set out trees with a carefully planned system of interplanted varieties, only to find that one variety develops unexpected weaknesses or is valueless for pollen. We all make mistakes, but only the alert learn by them and adopt helpful plans to supply a prompt remedy.

1934 AND 1935 PLUM AND PRUNE VARIETY YIELDS AT THE PURDUE FARM TEST PLOT, BEDFORD, INDIANA

By

C. L. Burkholder

Purdue Agricultural Experiment Station

In 1929 a planting of plum and prune varieties was made on the Purdue Farm at Bedford. At that time very little attention was being given this particular fruit in home orchards or commercial plantings and very little was known about the performance of even the better known varieties in this region.

No Japanese varieties have been included in this test because they are no more dependable croppers than peaches due to fruit bud kill by low winter temperatures. Early blooming also results in much increased danger of freezing at that time.

When fruit buds of any variety in the planting were killed by low winter temperatures, this variety has been replaced by another more promising variety. Plums and prunes should have a place in diversified commercial fruit plantings in southern Indiana if varieties are selected which will come through low winter temperatures which destroy the peach crop.

Resistance to Low Temperatures at Time of Bloom

In the spring of 1934 all of the original planting of varieties, in the sixth growing season, had a good bloom prospect except Sugar Prune, Bradshaw and Imperial Epineuse. A temperature of 26° occurred just after petal fall in 1934. Stanley and President were the only varieties which set a high per cent of fruit under these adverse conditions with French Damson next best and Hall, Yellow Egg, Robert's Prune, Hungarian Prune, Sugar Prune, and Pacific almost completely killed.

In 1935 a low temperature of 27° was recorded when most varieties were in full bloom. This low temperature again resulted in severe injury to many of the varieties. All varieties listed had a good bloom except Imperial Epineuse in 1935. Yellow Egg and German Prune were almost entirely killed. Robert's Prune, which is a late blooming German Prune, set a full crop as its buds were in the tight pink stage at the time of the freeze. Grand Duke, Stanley, President (poor quality), Bradshaw and Sugar Prune also set from 75 per cent to a full crop. French Damson was injured much more than in 1934, while Hall set a half crop as against a total failure in 1934.

It is of interest that most of the varieties in the first planting had a good bloom prospect in their sixth growing season, and all but Imperial Epineuse bloomed well in their seventh growing season.

It is also of special interest that in spite of the adverse weather conditions in both 1934 and 1935, that Stanley set practically a full crop both years and is one of the most promising new varieties in the planting. Stanley is a medium sized blue, free stone prune of excellent quality that is deserving of trial planting in southern Indiana.

A caution in the matter of insect troubles is the fact that all plums are very attractive to curculio and in 1933 a partial crop prospect on a few of the five-year-old varieties was destroyed in spite of several sprays with normal amounts of arsenate of lead. In 1934 and 1935 five

PRODUCTION RESULTS—1934 AND 1935

Variety	Date Harvested	Age	Number of Gallons		Number of Trees
			1934*	1935†	
Sugar Prune	Aug. 17, 1935	7	0 gals.	30 gals.	3
Bradshaw	Aug. 17, 1935	7	0 gals.	30 gals.	3
Pacific	Aug. 23, 1935	7	0 gals.	14 gals.	3
German Prune	Aug. 23, 1935	7	6 gals.	4 gals.	21
Diamond	Aug. 27, 1935	7	4 gals.	26 gals.	3
Grand Duke	Sept. 5, 1935	7	12 gals.	104 gals.	9
Stanley	Sept. 5, 1935	7	21 gals.	56 gals.	3
French Damson	Sept. 5, 1935	7	75 gals.	46 gals.	21
President	Sept. 5, 1935	7	8 gals.	56 gals.	3
Hungarian Prune	Sept. 5, 1935	7	0 gals.	16 gals.	3
Roberts Prune	Sept. 5, 1935	7	0 gals.	32 gals.	3
Hall Prune	Sept. 5, 1935	7	0 gals.	16 gals.	3
Reine Claude	Sept. 12, 1935	7	4 gals.	32 gals.	21
Yellow Egg	Aug. 23, 1934	7	3 gals.	0 gals.	3
Imperial Epineuse	.....	7	0 gals.	0 gals.	12

*A temperature of 26° occurred just after petal fall and is responsible for the low production on some varieties in 1934.

†A temperature of 27° occurred in full bloom in 1935.

pounds of arsenate of lead to 100 gallons plus linseed oil were used in three sprays and this gave control in spite of the unfavorable location adjacent to a large block of apple trees.

Most plum foliage is susceptible to cherry leaf spot and early season sprays must contain lime sulphur and the applications must be put on at seven day intervals during rainy periods the same as for apple scab.

APPLE SCAB IN 1936

MONROE MCCOWN

Purdue University Agricultural Extension

Each season, with its variations in weather conditions, adds an interesting and instructive chapter to the story of apple scab. Because the contribution of the past season was so unique the experiences of 1935 will not be soon forgotten.

Owing to a shortage of rainfall during the early part of the growing season in 1934, little scab developed in most Indiana orchards that season. Although there were exceptions to this rule, in no section was more than a minimum spray schedule necessary to prevent serious damage. The result was that in the spring of 1935 only a light source of infection was present in a majority of the orchards and particularly in those plantings located in the northern part of the state. The source of infection was, in fact, so light in many orchards that it was almost inconceivable that scab could develop to serious proportions even if 1935 weather conditions happened to be especially favorable to the disease. Fortunately, however, Indiana growers had such a high regard for the ability of the fungus to do the unexpected that the disease was generally well controlled in spite of the fact that weather conditions were especially conducive to an outbreak of scab.

Frequent Rains Favored Scab

The "big rain" began at about the time the early scab spores were maturing in most sections. With short intermissions, the rain continued until several weeks after the "normal scab season" is usually considered as past. The result was that in orchards which were not protected during the short intermissions apple scab showed a phenomenal development even to the extent of destroying foliage and crop.

In most cases the early infection was comparatively slight because of the light supply of ascospores which had been formed by the overwintering fungus within the old leaves on the ground. Temperatures and moisture conditions, however, provided conditions which were ideal for spore germination and rapid development of the disease resulting in the production of an abundance of secondary or summer spores. The chief loss was attributable to the activity of the summer stage of the disease. Whereas, ordinarily the chief development of the scab occurs prior to or by a week after petal-fall, in 1935 most of the damage occurred after that time.

Early Sprays Were Important

The importance of early spray applications was outstanding. Although there did not seem to be much to spray for prior to petal-fall, the early sprays prevented the light development of primary infections. This proved quite essential because it prevented the production of secondary spores, thus preventing the cumulative development of scab. By following an adequate early schedule, many growers found it possible to use a mild fungicide beginning at petal-fall or soon thereafter. On the other hand, growers who failed to apply sufficiently frequent early sprays found it necessary to use lime sulfur at "burn out" strengths at petal-fall or within the next two weeks with a resulting increase in fruit and foliage injury.

Timeliness Essential

Timeliness of application was extremely important. A typical example is taken from the experiences in a planting in north central Indiana.

The first scab spray was completed in this orchard on April 22. Four inches of rain fell on May first and second. The second scab spray was applied May 3rd, 4th, and 5th. That portion of the orchard which was sprayed on May 3rd developed very little infection. Good control was evident as the result of the spray applied May 4th, although somewhat more infection was observed than in that section of the planting which was sprayed a day earlier. Rather serious infection occurred in the block of trees which was sprayed May 5th (the fourth day after the rain began), necessitating the use of liquid lime sulfur at "burn out" strength in the seven to ten-day spray.

The number of gallons of material applied per tree also affected greatly the degree of control. In a few extreme cases only one to one and one-half pints of material per year in age of the tree was applied. This would amount to only two or three gallons of spray per application for a sixteen-year-old tree which should have received at least eight or ten gallons per application. These light applications usually prevented total destruction of the fruit but produced fruit which was very scabby—heavily "freckled" with secondary scab spots.

Trees in some orchards again showed very clearly a "high water mark" as proof of the failure of the operator to spray adequately (if at all) the tops of the trees.

Blossom Sprays

Sprays applied during the blossom period, originally used as a preventative measure in combating fire blight, are assuming greater importance in the apple scab control program. Since the apple blossom is susceptible to infection and a spray application can be depended upon to provide protection for a period of not to exceed one week, it is just as reasonable to believe that it is as necessary to protect susceptible portions during blossoming as during other growth periods. Observations and data from Indiana tests show conclusively that this reasoning

is sound. Thus, in seasons when rains occur during the blossoming period, extra sprays should be used. In certain areas in the state growers found it necessary to spray during the blossoming period in 1935.

Russeting

Russeted fruit was plentiful in Indiana orchards in 1935. This type of injury was evident quite early in the season. In Indiana, as well as in some other states, orchardists who applied blossom sprays (usually 2-6-100 Bordeaux) immediately condemned these blossom applications. Extensive observations in Indiana orchards and the results of Purdue tests showed, on the contrary, no reason for attributing the russeting to blossom applications. In general, the evidence indicates that the injury was due in large part to (1) weather, probably low temperatures, and (2) the use of lime sulfur under very humid weather conditions resulting in extremely slow drying of the material.

Purdue Spray Service

The accuracy of the leaf study method as a basis of prediction of scab spore maturity was proved beyond question. Following predictions of maturity dates, Mr. Baines continued to check upon the development of the fungus and found predicted and actual dates coincided in all cases. This service is invaluable to Indiana apple growers and has resulted in better control of apple scab with a minimum number of applications.

Mild Sulfurs

Although disease control is essential, it is becoming more and more evident that the effects of spray materials upon leaf efficiency must be considered also. Recognizing the need for efficient fungicides which are less caustic than lime sulfur, investigations representing State, Federal, and commercial organizations have developed various substitute materials. These milder materials, although they apparently cannot be depended upon to entirely replace lime sulfur as it is now used by the average apple grower, are rapidly finding a place in the spray programs of, especially, the more experienced growers who are aware of the limitations and possibilities of these materials.

In general, the use of these milder materials, particularly after the pre-blossom application, seems to result in better fruit finish and less foliage injury. The grower must recognize, however, that since these materials are less caustic, they are preventatives only and can be used beginning with petal-fall, only if the schedule previous to this time has been such that scab has been controlled. These mild sulfurs apparently cannot be depended upon to burn out early infections. They are frequently fortified with very weak dilutions of lime sulfur.

Apple Scab in 1936

Although Indiana apple growers as a group are to be congratulated for the way in which they handled the scab situation in 1935, they should realize that only by adjusting their spray schedules to meet sea-

sonal variations can they continue to hold this disease in check. The source of infection is especially abundant. If weather conditions during the early part of the 1936 growing season favor the development of scab, Indiana growers can expect to put up a harder fight than they did in 1935 to prevent serious damage. Time has proved, however, that any Indiana grower can control this disease if these few rules are followed:

1. Time the first apple scab spray by the information obtained by the leaf studies at Purdue. A card addressed to the Division of Horticulture, Department of Agricultural Extension, Purdue University, will place any grower upon the mailing list to receive this information.

2. Only one card, advising of the date when apple scab spores will be sufficiently mature to be discharged by the first rain, will be mailed to growers. This will assist growers to time the first scab spray. Later sprays will be timed by frequency of rainfall. Following the first spore discharge, spray once a week during rainy weather which occurs between that time and, normally, about 7 to 10 days after petal-fall. However, in seasons such as 1935, fungicides should be used as long as cool, rainy weather continues.

3. Insofar as possible, apply the spray by the third day after a critcal rain begins. Growers who have insufficient equipment to cover the orchard in a two to not exceed three-day period must either (a) decrease the time required to cover the orchard by hauling water to the sprayer; by installing more filling tanks in the orchard; by spraying at night as well as in the daytime during critical periods or by adding more equipment, or (b) keep the orchard covered by spraying once a week regardless of frequency of rainfall.

4. Spray the entire tree. This necessitates careful application of the material to all parts of the tree and the use of a sufficient number of gallons per tree. In general, well grown trees should receive a minimum of one-half gallon of spray for each year in the age of the tree at the beginning of the scab season. The amount should be gradually increased to at least three-fourths gallon for each year in age of trees as the tree approaches full leaf in the latter part of the scab season.

RELATION OF TWIG DIAMETER TO HARDINESS OF PEACHES

Professor M. A. Blake, New Brunswick, N. J.

The killing of the fruit buds of the peach by low temperatures in winter is one of the handicaps to peach growing in any district where the winter minimum is constantly lower than 5 to 10° F. below zero. The actual temperature at which the buds will be killed depends upon several factors, one of which is the relative dormancy of the buds when the cold is experienced. This factor is well understood by peach growers and does not require explanation.

In recent years, the writer has been devoting considerable study to the relation of the growth status of different varieties of peaches and apples to the yield and quality of the fruit produced. During the winter of 1934-1935 low extremes of temperature resulted in severe injury to the fruit buds of the peach in many orchards in New Jersey. The fruit

buds of most varieties in most orchards at least, were in as dormant a condition as they are ever likely to be in New Jersey in winter. It provided a favorable opportunity to study the effect of factors other than variable temperatures on hardiness.

Diameter of Fruiting Twigs

Experienced peach growers have observed from time to time that the fruiting twigs from 3 to 18 inches in length upon the trees of any given variety appear to be thicker or of greater diameter in some orchards than others or upon different trees in different parts of the same orchard. They have noted further that the set of fruit buds sometimes varies with this apparent difference in twig thickness. The need was for some exact measure of these variations and their relationship, if any, to commercial production.

Orchard Observations

Preliminary observations in several orchards in New Jersey in March, 1935, indicated that the relatively thin fruiting twigs of a variety had less fruit buds and a higher percentage of winter killed buds than thick twigs of the same length. The problem then was to find orchards and trees where a fair comparison could be made. It was obvious that it would be useless to compare two orchards in different localities or orchards at different elevations and it was necessary to have trees which had experienced some bud killing but not a too severe loss of buds which would eliminate the possibility of the desired data.

An ideal set of conditions was finally found when trees at the same elevation and of the same variety, Elberta, varied markedly in growth status in different parts of the same row. Marked variations also occurred in the diameter of the fruiting twigs upon different parts of the same tree in some cases. Results from the varieties Iron Mountain, Belle, and Cumberland were obtained in addition to Elberta, but are not reported in this article.

Selection of Twigs

Samples of both thin and thick twigs selected for study were all annual growths which had developed directly from older wood. No short side branches of current growth were included. The samples were all cut at a height of about 5 to 7 feet above the ground and from trees at the same elevation. All of the twigs were selected under the supervision of one person in order to insure uniformity. The summarized results obtained from Elberta are given in the accompanying table.

The outstanding fact disclosed by these studies is that thin twigs as compared to thick twigs of the same length had a lighter bud set which experienced much more severe winter killing during January, 1935. The data also reveals in the case of the variety Elberta that bud killing was slightly more severe upon the short but thin twigs than upon twigs 10 to 16 inches in length. Upon thin twigs 18 inches long, however, the fruit buds experienced considerable injury. In the case of the thick twigs, the percentage of bud killing was also slightly less upon

those 8 to 14 inches long than upon the short growths. In a similar study upon Belle the percentage of bud killing upon the rather short twigs was slightly less than upon the longer twigs.

It is clear that greater resistance to low winter temperatures is possessed by fruiting twigs of the peach that are relatively thick for their length. This is logical because such twigs are likely to possess a more favorable composition to resist cold. Relatively thin twigs also tend to produce smaller and less desirable fruits than relatively thick twigs of the same length. The peach grower should, therefore, strive to obtain such a growth status of his trees that the fruiting twigs will be relatively thick in diameter for the variety.

COMPARISON OF THE SET OF FRUIT BUDS AND THE PER CENT OF LIVE BUDS UPON THIN AND THICK ANNUAL GROWTHS OF THE ELBERTA PEACH:

Thin, Light Twigs				Thick, Heavy Twigs			
Ave. Length	Ave. Diameter	Ave. No. Fruit Buds	% Buds Alive	Ave. Length	Ave. Diameter	Ave. No Fruit Buds	% Buds Alive
2.1	.095	1.8	0	1.9	.112	5.1	59.02
3.9	.106	4.5	6.78	4.1	.122	7.4	58.33
6.0	.113	6.5	10.71	6.0	.131	10.3	56.45
8.1	.122	8.9	13.79	8.0	.140	10.8	67.86
10.1	.130	9.8	15.31	10.1	.155	9.3	70.27
12.1	.140	8.7	32.69	12.0	.165	12.6	68.32
13.9	.144	11.8	23.73	14.0	.177	15.3	64.75
16.0	.154	13.5	24.07	16.1	.186	17.6	53.41
18.4	.17	24.0	11.11				

What Constitutes Proper Twig Diameter?

The fruiting twigs of the peach vary in diameter according to variety and length. The difference between thick and thin twigs of any given length while easily detected by the eye is a matter of hundredths of an inch which cannot be determined by an ordinary foot rule. A caliper designed to measure hundredths of an inch is required. The next point is what constitutes a satisfactory twig sample upon which to base an estimate of the general type of growth and the bud set of a tree?

How to Sample

It is suggested that growers select the same kind of a twig sample as that recommended in the New Jersey Standard of Judging the Bud Set of Peaches. Such a sample consists of 6 to 8 annual terminal growths approximately 12 inches in length at the tips of strong side branches about 5-7 feet above the ground. In other words, the thickness of the 12-inch annual growths should be rather closely correlated with that of shorter or longer growths on the same tree. Vigorous, dormant, well developed, terminus growths of Elberta 12 inches long will be unbranched and should caliper about .18 inch. Twelve-inch fruiting twigs of peach should caliper about .18 to .19 of an inch when measured at a point 0.75 to 1.0 inch from the point where they developed from the older wood. When twelve-inch fruiting twigs of Elberta caliper .16 of an inch or less in New Jersey, the bud set is likely to be low and also their resistance to low winter temperatures.

The question may be raised as to whether the caliper of the twigs can be too thick to be desirable. Vigorous but slightly girdled trees or trees injured in such a manner as to cause a similar effect to girdling might develop excessively thick twigs upon which the buds would be more susceptible to killing by low temperatures in open winters. Twigs of a good normal thickness should, therefore, be the objective of the grower.

What Factors Cause Thin Twigs

A number of factors or combinations of factors may cause a peach tree to develop relatively thin fruiting twigs in proportion to their length among which may be mentioned the following:

1. A too dense and moist soil and lack of aeration.
2. Deficiencies of magnesium, phosphorus or potash.
3. Excess of nitrogen when it results in a too vegetative growth.
4. A deficiency of nitrogen sufficient to inhibit carbohydrate synthesis.
5. Injury to the tree in early spring by leaf curl, spray burn or by any caustic material applied to the soil which results in serious early defoliation.
6. Defoliation, if severe, by bacterial leaf spot or other factors.
7. Too close planting resulting in insufficient light for the fruiting twigs upon the side and lower branches of the tree.
8. Lack of proper pruning which results in tall, leggy trees with weak lower branches and fruiting twigs.
9. Excessive pruning or cutting back of branches of trees already making a free growth resulting in a too dense top and a too vegetative growth status.
10. A too heavy or unthinned crop particularly when associated with drought and high temperatures.
11. Some disease of which the cause is unknown, including false little peach which may be a nutritional disorder.

APPLES—IN A BOX OR A BASKET

By K. I. Fawcett

Purdue Agricultural Experiment Station

Not so many years ago the apple industry of the East and the Middle-west was divided into two groups because one group of growers favored the old standard barrels as the ideal apple package, the other, looked upon as being radical, favored the then new bushel basket. Needless to say, the basket was adopted as the apple package.

The bushel basket in one form or another has been the standard container since it replaced the barrel, but now a new one bids well to surpass the basket. Again there are two groups, one favoring the old standard bushel basket, the other the new bushel crate or box.

One group favors the basket because the consumer for years has bought his apples packed in a basket and it is afraid apple sales will fall off if they are offered for sale in any other container. (Boxed apples may be associated with high retail prices.) The other group wants the box because it will dress up the package and increase apple sales.

To determine what the trade thought of any change in apple packages, the Purdue Agricultural Experiment Station recently made studied practices on some of the large Midwest markets. The results indicate that well over 60% of the apples sold on the Cleveland, Toledo, Detroit, Chicago, and Milwaukee markets this year were in boxes. The general belief was that the box would replace the basket in the near future.

The box has several advantages over the basket but chief among them is the adaptability of this container to storage space. At least 20% more apples can be stored in boxes in a given space than in baskets and this affects storage rates. From the trucking standpoint the same is true.

On the Detroit market there has developed a system whereby the crates or boxes are used over again. Many of the larger commission houses purchase the crop of entire orchards and they furnish the packages. The apples are sold in all types of boxes and crates and the purchaser is charged for the containers he takes out. A refund is made when they are returned. Such a plan involves additional bookkeeping but with such a plan, well made crates can be used for several years. Since many of the apples sold in Toledo are bought on the Detroit market and trucked over, the returnable crate idea is used quite extensively. In Chicago and Milwaukee this plan hasn't even been considered.

Bruised apples in the face of practically every basket, especially if the apples are at all roughly handled is expected. This bruising is eliminated to a great extent by the use of boxes even though the fruit be jumble packed.

There were differences of opinion as to whether boxes should be jumble packed or faced, but facing seemed to sell the apples and at a price that would justify the added labor. The experience here at Lafayette has been that even though an attractive face be put on the boxes at the packing shed it had practically disappeared by the time the apples were moved from storage. One grower suggested that all boxed apples be jumble packed and the public educated to not want faced boxes.

The use of the box liner and pad meets with more favor than the liner that folds over the top.

The jumble packed box is better adapted to inspection than is the bushel basket because when several apples are removed from the face of a basket they are seldom put back in place. Jumble packed boxes allow the customer to inspect all the apples without causing any damage. Jumble packed boxes do not encourage overfacing and this may be a good thing for the entire apple industry.

Last fall 400 boxes of 2½" and 2¾" Delicious were packed out on one side of the apple sizer while standard tub bushels were being filled

on the other side. The boxes were faced and filled with a pad and two strips on top. The boxes were stacked on the side to take care of a slight bulge but it was soon realized that two strips were not enough to hold the apples in place. A third strip was nailed in the middle and it was then possible to stack them on the side. The average weight of the box was 50 to 52 lbs. net. Inadequate equipment and the inexperience of the packing crew in packing boxes slowed operations considerably. However, with more experience and better handling facilities it seems reasonable to believe that nearly as many boxes can be packed per day as baskets.

These 400 boxes were marketed with the rest of the crop through a local commission firm. They were sold to grocers and every grocer handling any of these boxes was contacted to see what he thought of the box as a container for apples.

Remembering that the commission men and large buyers of apples on the Midwest markets favored the box it was expected that the 44 grocers who used these boxed apples would have the same preference but this was not the case. Twenty-one grocers preferred baskets, 11 the box, 11 had no preference, and 1 wanted both baskets and boxes.

Twenty-five of the grocers selling these boxed apples were doing business in towns with populations from 500 to 10,000. Nineteen were in a city of some 30,000. Of the 25 grocers in the smaller towns, 15 preferred baskets, 7 boxes, 1 both boxes and baskets and 2 had no preference. In the larger center 6 of the 19 grocers preferred baskets, 4 boxes, and 9 had no preference. In other words, the grocers in the smaller towns wanted baskets and those in the small city had no decided preference.

There were many reasons given as to why the grocers in the smaller towns preferred baskets. The consumers in most cases were farm people and if they bought a bushel of apples they wanted it in a basket because it could be used on the farm. The baskets had a resale value for the grocer. They were also skeptical of the box because it had always been associated with extra fancy fruit that sold at a higher price. Then too, the box suggested large counted apples, so large that a small child would eat part of the apple and waste the rest.

Four of the 7 grocers preferring boxes were in towns larger than the average of the survey but smaller than Lafayette.

The city grocers (9 out of 19) had no preference for the box or basket. In many cases the apples were displayed either in wire cages made for that purpose or in the show window, so the package would make no difference. If the fruit was displayed in the original container they felt that no more apples were sold from the box than the basket. Those grocers who preferred the box wanted it because it showed the fruit to better advantage and the apples were not bruised as they were in the baskets.

This survey was made primarily to determine the present status of the apple box, however, other points were brought out. The average grocer doesn't care if the apples are in baskets or boxes but he does want a pack in which the apples in the bottom of the container are somewhere near the grade of those in the face. More than one grocer said he bought certain brands of apples week after week because he knew

from experience that the apples in the bottom of the container were as good as those on top. These same grocers will demand the same apples next fall and it is the repeat orders that help dispose of every apple crop.

RESULTS OF THE 1935 APPLE WASHING STUDIES

By C. L. Burkholder and O. W. Ford

Purdue University Agricultural Experiment Station

In 1935 most of the apple washing studies were carried on at the Purdue Orchard at Bedford, using an underbrush-flood washing machine. Grimes and Winesap were again used as representative of commercial varieties picked in September and October in Indiana. All of the removal treatments were with hydrochloric acid or with acid plus a wetting agent.

Time of Exposure—The time that the fruit is in contact with the cleaning solution naturally will determine to some extent the per cent of lead and arsenic residue removed. The underbrush-flood type washer, used in most of this work, has two standard exposures, a 20-second or a 30-second gear regulation. The small model used in 1935 would handle 35 bushels per hour at the slow speed or 30-second exposure, and 60 to 65 bushels per hour at the fast or 20-second exposure. Many growers have bought or will buy apple washers which have too small a capacity for the production of their orchards. Therefore, a study of the relative efficiency of the two exposure speeds has a practical application in packing shed management.

Both the 1934 and 1935 results indicate, that with this particular style of washer, a 20-second exposure is nearly as efficient as a 30-second. For instance, if 86 per cent of the lead load is removed by a 20-second exposure to a given treatment, a 30-second exposure will remove approximately 88 per cent of the lead load—not a big increase in efficiency, considering the reduction in bushels per hour that comes from slowing down the washer.

Removal Efficiency Without Heat—The underbrush-flood type of washer will give a high removal with cold cleaning solutions. In 1935, a Grimes lead load of .205 grain per pound was reduced to 86 per cent or to .028 by a cold treatment of 20 seconds in 1½% acid. (Washed same day picked.) Winesap are always more resistant to cleaning and in 1935 a lead load of .10 grain per pound was reduced 75 per cent by the same treatment or to .025. The percentage removal would have been higher if the original lead load had been as much as on the Grimes samples.

Increasing Temperature—Raising the temperature of the wash solution 20 degrees above the packing shed temperature, was equal to, or of more value, in residue removal than slowing down the washer from 20 seconds to 30 seconds exposure. From the standpoint of packing shed management, the cost of increasing the temperature of the washing solution 20 degrees is often much less than the cost of decreased pack out of fruit resulting from slowing down the washer.

Increasing the temperature from 67 to 100 degrees stepped up removal from approximately 86 per cent to 92 per cent on Grimes and

from 75 per cent to 85 per cent on Winesap. (See table.) It is often a comparatively easy matter to clean varieties such as Grimes and Jonathan with cold cleaning solutions, while Winesap, receiving the same spray schedule, may wax up on the tree and be so resistant to cleaning as to require heat. If lead loads are expected to run over three times the present tolerance, it is wise to be prepared to heat the washing solutions.

Value of a Wetting Agent with Cold Acid—Vatsol added to 1½% cold acid at the rate of either 1 pound or 6 pounds to 100 gallons failed to increase removal over cold acid alone. However, when 6 pounds of Vastol was added to 100 gallons of cold 2¼% acid, an increase in removal was noted on Winesap but *not on Grimes.* No evidence of injury resulted from this treatment at 20 seconds exposure.

Value of a Wetting Agent with Hot Acid—Vatsol at the rate of 1 pound to 100 gallons of 100 degree, 1½% acid failed to increase removal. When the Vatsol was increased to 6 pounds to 100 gallons of 100 degree acid there was an increase in the percentage removal on both Grimes and Winesap. (See table.) When 6 pounds of Vatsol was added to 100 gallons of 2¼%, 100 degree acid no increase in removal was noted.

It must be kept in mind that the underbrush-flood type of washer gives the fruit a thorough scrubbing and violent flooding with the cleaning solution. It would be expected that these results with Vatsol would not necessarily hold true with flotation or flood type washers.

Comparative Efficiency of Washers—As in 1934, the 1935 results show the greatest efficiency for the underbrush-flood type of washer. However, where lead loads are not high, say three to four times the present tolerance, the flotation washer can be used very nicely but will not polish the fruit and remove visible residue and dirt unless used in conjunction with a dry cleaner. There is also less risk of mechanical injury to the fruit and fewer repair bills with the flotation type of washer. The accompanying table shows a few representative laboratory samples giving the lead removal obtained with several types of washing

A FEW REPRESENTATIVE ANALYSES SHOWING PERCENTAGE OF LEAD RESIDUE REMOVED BY VARIOUS TREATMENTS AND BY THREE TYPES OF WASHING EQUIPMENT

Treatment	Grimes	% Removal	Winesap	% Removal
Underbrush-Flood (Lead Removal)				
No treatment	.205		.100	
1½% HCl @ 67° for 20 seconds	.028	86	.025	75
1½% HCl @ 100° for 20 seconds	.015	92	.015	85
1½% HCl, ¾% Vatsol @ 100° for 20 seconds	.011	94	.011	89
1½% HCl, ⅛% Vatsol @ 100° for 20 seconds	.019	90	.015	85
1½% HCl, ⅛% Vatsol @ 67° for 20 seconds	.034	83	.024	76
2¼% HCl, ¾% Vatsol @ 69° for 20 seconds	.027	87	.016	84
2¼% HCl, ¾% Vatsol @ 69° for 30 seconds			.014	86
Flotation (Lead Removal)				
1% HCl, ⅛% Vatsol @ 80° for 1½ min.	.045	78	.024	76
Tandem of Brush Unit and Flotation (Lead)				
Through brush unit for 30 sec. in 1½% HCl, ⅛% Vatsol @ 105° then Model X flotation with 1½% HCl, ⅛% Vatsol for 1½ min. @ 82°	.018	91	.017	83

equipment and washing solutions. Duplicate samples of Grimes and Winesap were used which had been heavily sprayed with 5 applications of oil-lead arsenate in addition to the calyx and 7-day sprays. The last cover spray was finished the first week in July. One-half pound of soap was added to the oil-lead in five cover sprays on Grimes but not used on Winesap.

SUMMER MEETING IS SUCCESSFUL

An attendance of approximately 250 was reached at the one-day Summer Meeting on August 12 at the Doud Orchards in Miami County. Shortly after ten o'clock, 50 or more individuals started out on a tour through the home plantings of the orchards with Mr. L. V. Doud and Professor C. L. Burkholder in charge. About ten minutes later a larger group started on the same tour with Mr. W. W. Doud and Professor Monroe McCown in charge of discussions, questions, etc.

Results of Good Management

The results of a very good program of management were evident especially in the older bearing block of trees as there was a good crop on nearly all the trees this year. Certainly a good production in a year which represents the shortest apple crop produced during the past 15 years is worth more than a good crop where it's just one more among many. A short sod rotation with extra mulching material around the trees has helped this orchard to produce nine crops during the past ten years.

Grasshopper Infestation

In the younger orchard consisting of trees three and four years of age, there was a rather severe infestation of grasshoppers. This pest was responsible for the destruction of trees on approximately ten acres during the 1935 season. In reply to a question regarding the probable damage this year, Mr. Doud replied that the result would depend very largely upon just how long the pests would continue to exhibit their ravishing appetites in the same area. Several young trees were observed which contained few or no leaves but the question of whether the insects would continue on and eat the bark and buds was the one which would tell the story of whether it would result in death for the young trees.

A good flock of about 200 turkeys would no doubt relieve the grasshopper situation considerably in this orchard.

Control Measures

A question was asked about the possibility of spraying the alfalfa cover crop in this orchard with a stomach poison. Mr. G. E. Lehker, Extension Entomologist, stated that such a method would be only partially successful and very expensive. A poison bran bait would prove much more successful according to Mr. Lehker.

A side-hitch "hopper-dozer" had been rigged up but it was the general opinion that it would be much more successful if it could be put on small wheels and pushed in front of the truck. Crankcase oil was the killing agent used in the bottom of the "hopper-dozer."

Codling Moth Bait Traps

The Doud Orchards represent one of the several northern Indiana orchards in which the Entomology department is operating codling moth bait traps. Mr. Lehker explained their value and general operation, stating that they were valuable in helping to obtain information in individual orchards. During recent years it has often been difficult to arrive at general comparative conclusions relative to codling moth emergence and activities in the same latitude as most orchards represent individual cases. By using the individual bait traps, sprays can be more accurately timed and consequently more effective.

Afternoon Program

After the preliminaries consisting of an address of welcome by Lloyd Berger, vice-president of the Miami County Horticultural Society, and a response by Homer Coffing, president of the State Society, Mr. L. V. Doud presented some of the reasons why he has been able to maintain successful production over a period of years. We shall attempt to get a written article from Mr. Doud for a future issue but for the present, we shall mention the seven key points contained in the address.

1. Maintain proper conditions for an adequate root system.
2. Maintain an adequate supply of available plant food.
3. Choose and maintain proper soil for best moisture relationship.
4. Control insects and diseases attacking the foliage.
5. Avoid concentrated or caustic sprays where a milder spray will give the desired result.
6. Take measures to prevent excessive production for any given year.
7. Follow a program of light annual pruning.

Moisture Relations in the Orchard

Dr. C. E. Baker gave a number of good points on moisture relationships which included helpful thoughts on irrigation practices, mulching with various types of materials, sowing of annual or perennial covercrops, time and method of sowing, etc. He reviewed some of the experimental work which has been done in other states and which is generally applicable to Indiana conditions. Mr. Baker will plan on furnishing a written article on this subject for a future edition of Hoosier Horticulture.

Value of Mulches

In this connection it is of specific interest to mention that in one experimental orchard in Washington state, with the use of a mulch composed of four to six inches of straw and alfalfa hay, the number of irrigations was reduced from five to three and good growth condition of fruit and wood was maintained throughout the summer.

Indiana growers can well afford to make an annual application on

mature trees of at least a bale of straw per tree. At an investment of about 20 cents per bale with trees around 35 feet apart, this would represent an investment of about $7.00 per acre. With the threshing season just recently completed, negotiations for straw should be more easily made now than later.

Trends in Fruit Packages

Meredith Reed of Vincennes handled this subject in good shape as a result of his practical experience in packing apples in boxes. In general he is finding increased favor in the use of the box although for immediate consumption he would pack in baskets.

The box which he used last year was 11x17x14 inches which packed around 50 pounds of most varieties. He figures a packing cost of three cents additional for the box which is made up of a slight increase in both package and labor costs. Boxes can be hauled easier and stacked higher in trucks and storages and the season storage cost is from three to five cents cheaper for the box.

A Task Well Done

The officers and membership of the Society were very unanimous in their expressions of appreciation for the good work done by the Miami County Horticultural Society. The local officers are L. V. Doud, president; Lloyd Berger, vice-president, and Roger Kraning, secretary-treasurer. These men together with County Agent J. E. Wylie, and their committees on arrangements, eats, etc., all completed a much appreciated task of making the 1936 Summer Meeting a successful one.

HANDLING THE OLD PEACH SITE

Monroe McCown

Division of Horticulture

The proper course of procedure to be followed in the treatment of the old peach site is a problem facing those growers whose plantings were destroyed by low winter temperatures. The tendency of those growers who feel that the performance of the previous planting will justify a new planting may be to replant immediately the same site to peaches. Past experience indicates, however, that such a procedure is not advisable.

A majority of these previous peach sites in Indiana have been devoted to the growing of peaches for the past 12 to 20 years. Aided by the prevailing system of clean cultivation the loss from sheet erosion during this period of time has been great particularly in orchards on heavier soils. The results of this loss are more serious, of course, if a limiting layer of "hardpan" is close to the soil surface. All peach orchard soils have been depleted of organic matter unless regular applications of manure or other organic materials have supplemented the turning under of green manure crops. Furthermore, the black peach aphis has in some cases practically prevented the establishment of young

trees on an old orchard site when the site was replanted in less than three years after removal of the old trees. *Chiefly as the result of the above conditions growers have found it very difficult to obtain satisfactory growth of trees planted on such sites without preceding the tree planting with an intensive soil building program for a period of at least three seasons.* Even an intensive soil building program has not converted a shallow soil into a profitable peach soil and such soils should be avoided. If the grower desires to make a new planting immediately a new site with adequate elevation and deep, well-drained soil should be selected for planting.

In preparing the old site for planting (actual planting to be delayed at least three years) the trees now occupying the land must be removed. This is most commonly done by dehorning the trees and pulling the stumps with a tractor. The field is then leveled by deep plowing followed by several discings. In the past growers have made the mistake of planting on slopes sufficiently steep to require terracing and contour planting to prevent serious loss from erosion. If trees are removed by some time in September a winter cover of rye or wheat can be sown. Even if tree removal is delayed until spring a winter cover can be sown between the trees. Many growers may prefer to use annual covers (rye, wheat, soybeans, cowpeas) in the soil building program; however, the use of deeper rooted covers (alfalfa, sweet clover, red clover) would seem advisable on the heavier soils. Supplement the green manure crops with available manure. The use of fertilizer will improve cover crop growth providing more volume to be incorporated in the soil. In preparing for the first seeding the average soil should receive about 300 pounds per acre of superphosphate and about 100 to 125 pounds of the same fertilizer per acre annually when seeding annual covers. Use lime as needed to establish the cover.

INDIANA WINS AT INTERNATIONAL HORTICULTURAL EXPOSITION

The first International Horticultural Exposition was held at Chicago, September 12-20, in the spacious International Amphitheatre at the Union Stock Yards. The results for the first show of this kind were highly gratifying.

The Indiana Exhibit won first place in the classification for State Horticultural Societies. Minnesota was second, Missouri was third, and Illinois was fourth.

Excellent Coöperation

With the State Fair closing on Friday night and the Chicago Exposition opening on Saturday at noon, time was a valuable item and some of us forgot all about sleeping.

Those largely responsible for setting up the display were E. L. Mitchell and Fay Gaylord, vegetables; Mark Byers and your Secretary, fruits; E. R. Honeywell, flowers; Ben Wilkins, Apiary Inspector, honey; and Laurenz Greene, head of the Horticultural Department.

Those furnishing fruit included Dixie Orchard Company, Vincennes; Doud Orchards, Denver; V. V. Clark (peaches) Bristol; Simpson Orchard Company and Luther McDonald, Vincennes, and Bradford Orchards, John Smith, and several other exihibitors at the Fair. Only a tray or a plate or two was furnished from the Fair by some exhibitors but every exhibitor was willing to coöperate freely and this interest and generosity was much appreciated.

Wilder Medal Award

The Wilder gold medal was included in the first place award and it will be kept at the Horticultural Building at Purdue. It is always a very distinct honor to receive such an award and we are sure our membership is proud of the Indiana success in the First International.

Hanging Gardens of Babylon Reproduced

Cut flower, formal and informal garden arrangements, special floral and table arrangements, etc., comprised much of the show space. The artist's arrangement of the historical hanging gardens of Babylon at one end of the great arena was very beautiful and deserving of unlimited praise.

Individual Winners

Individual winners in fruits included Mark Byers, Luther McDonald, Simpson Orchard Company, Doud Orchards, and Shauer's Flint Lake Orchard at Valparaiso. Byers won eight blue ribbons and several other ribbons and Mr. McDonald took sweepstakes on plates with a Starking entry. These prizes were only "personal knowledge" results by your Secretary, but it is quite certain a few other Indiana orchards would be included if the list could be completed.

Indiana vegetable winners included E. L. Mitchell, Rochester; H. W. and H. H. Emme, Butler; Lawrence and Eugene Troyer, LaFontaine; Keller and Wilson, Crown Point, and others.

John Wingate, Muncie, was first in the light comb honey class and second in the observation hive of bees.

Prospects for 1937 International Show

With the experience of the first show, together with a better crop and a constantly increasing interest in local, state, and national shows in the horticultural profession, we should have every reason to feel that the Second International Horticultural Exposition will be more outstanding in every way.

TOP-WORKING GRIMES ON VIRGINIA CRAB

By C. L. Burkholder

Purdue University Agricultural Experiment Station

The root stock studies carried on by the Purdue University Agricultural Experiment Station have rather clearly shown that Grimes and

Ben Davis with Virginia Crab root systems make superior trees as compared to those grafted on French seedling roots. This does not necessarily mean that other commercial varieties on Virginia Crab root systems would be superior.

Unfortunately, it is a rather difficult process to produce commercial quantities of nursery trees with Virginia Crab root systems. The normal nursery method used is to graft a named variety on a French seedling root, or bud into French seedlings. As there is no supply of trees available with Virginia Crab root systems, it has been suggested, where new Grimes plantings are to be made, that Virginia Crab trees be purchased and grafted or budded to Grimes after one or more year's growth in the orchard. The Haas variety is another which is very promising as a stock for Grimes and Jonathan according to the Iowa Agricultural Experiment Station.

The commercial "double-worked" or "double life" Grimes trees are not the success that was hoped for them. In 1920 the Purdue University Agricultural Experiment Station set a six-acre block of Grimes at the Experimental Orchard at Mitchell. This planting consisted of Grimes grafted about twenty inches above the ground on five different stocks. There were originally 48 trees on each variety of stock. At the end of the sixteenth growing season the condition of the entire block of trees is shown in the following table.

	Dead	Dying	Alive
Grimes on French Seedling Root*	26	2	20
Grimes on Delicious	22	6	20
Grimes on Walbridge	25	3	19
Grimes on Arkansas Black	24	8	16
Grimes on N. W. Greening	32	3	12
Out of 240 trees planted 1920	129	23	87

*Often called "single-worked trees." The entire body and part of the underground portion of the trunk is of Grimes wood.

It is evident from these figures that there was very little difference as between the four stocks used and that top-working Grimes twenty inches above the ground on four promising stocks did not prevent a ruinous loss of trees from Phytophthora and winter killing on the bodies and crotches of the trees. The fifth block of Grimes root grafted directly on the seedling root seemed to be in about as good condition. By top working the Grimes out on the scaffold branches of a variety such as Virginia Crab or Haas, it should be possible to preserve practically a full stand of Grimes trees for the first twenty to twenty-five years of the life of such a planting.

While there seems to be an ample supply of Grimes for present market demands in Indiana, the heavy death rate in bearing blocks of this variety will greatly reduce production during the next ten years. Planting of Grimes just reaching the bearing age are sure to suffer heavy tree losses from body troubles, whether commercial double-worked, or single-worked trees are used.

Professor T. J. Maney of Iowa State College has called our atten-

tion to several mature orchards in Iowa that were top-worked on Virginia Crab and Haas which have an outstanding record for production and percentage of trees still alive and in a vigorous, healthy condition. In northern Ohio, Grimes top-worked on Tolman Sweet have been heavy producers and show no sign of limb injury of any kind. The only additional expense to the grower is the labor involved in the actual top-working operation. It takes ten long years to grow an apple tree to a profitable productive age. Some trouble and forethought in building this tree so that it will then produce heavily over a long period of time is well worth the careful consideration of the commercial apple growers in Indiana.

If Virginia Crab or Haas trees (grafted on French roots) are planted at least two inches deeper in the ground than normal, the production of (scion) roots above the graft will be encouraged. This will result in a root system composed partly of French seedling roots supplemented by additional roots from the Virginia Crab, or Haas body. Grimes worked onto the branches of such a stock would then have a superior root system as well as body and crotch resistant to fungus disease and winter injury. The record of top-worked trees in the W. P. Campbell Orchard, Woodbine, Iowa (orchard planted 1893-94), is well worth considering and is taken from the *Iowa State Horticultural Society Report*, Vol. 69, 1934.

Variety and Stock	Trees Alive 1914	Trees Alive 1934	Percentage Trees Alive 1934
Grimes on French Crab	72	3	4.0
Grimes on Virginia Crab	22	16	72.0
Grimes on Haas	135	52	38.0
Grimes on Sheriff	9	7	77.0
Gano on French Crab	84	3	3.5
Gano on Sheriff	37	26	70.0
Sheriff on French Crab	108	66	61.0
Jonathan on French Crab	113	30	26.0
Jonathan on Virginia Crab	13	7	54.0
Jonathan on Haas	14	36	82.0
Jonathan on Sheriff	2	2	100.0

APPLES THE FOUNTAIN OF LIFE

L. B. Skeffington, Special Newspaper Writer

Rochester, N. Y.

"The apple, more than any other food with which we are acquainted, possesses in the highest degrees therapeutic advantages. . . . It is undoubtedly this that justifies the high place it occupies in folklore and that it should occupy in our estimation."

There you have the secret of the apple's ancient popularity, but you do not have to accept it merely as a legend. Dr. Ira A. Manville, director of the nutritional laboratory of the University of Oregon Medical School, has put those legends to clinical test.

"Science at last has supplied the reason why the apple has been esteemed through the ages for its healthful properties," he told the International Apple Association recently. Naturally, association members hold the apple in high esteem and they were ready to believe well of their favorite fruit. But the savant ignored the oft-repeated sentimental appeals and recited cold facts proved by scientists seeking only the truth. . . .

He presented statistics relating to children's diseases. "The success attending the use of raw apple pulp or of apple powder in milk formulae in the treatment of infantile intestinal diseases is nothing short of marvelous," he said. Note that the doctor, a member of a professional group which usually leans over backward to be conservative, used the adjective *"marvelous."*

He recited that the death rate among children fed on cow's milk is far higher than that of children fed on mother's milk. To improve the life-giving qualities of cow's milk medical men have fortified it with apple pulp.

"A careful summary of all the case histories reported shows that 1,021 children have been treated for various intestinal disorders with raw apple pulp. Of these, 1,005 showed complete recovery, while 16 failed to respond," he said.

This would seem to be so clearly conclusive that there is no argument. But Doctor Manville throws more light on the tests: "This is remarkable when it is considered that many of the individuals receiving this type of thereapy were not placed on this treatment except as a last resort."

In other words, when other things failed, Old Doc Apple came through with flying colors! "The use of apple powder is meeting with equal success," according to Manville. "Apple in the latter form is especially desirable since it exists in a form capable of being stored so as to be available the year around and represents a product of uniform and known potency."

When this fact becomes generally known it may be expected the family medicine cabinet never will be without a package of powdered apple, to guard against the calamity of not being able to obtain fresh apples and apple pulp.

"When the therapeutic value of the apple is more generally recognized—and this is simply a matter of education—it will be used prophylactically as much or more than any therapeutic use to which it may be put," Dr. Manville says. "I do not hesitate to say that to children in the large cities and to those living in areas where it is common for the temperatures to reach high levels and hold these levels for long periods of time, such methods of prophylaxis of therapeutic treatment will prove to be one of the greatest blessings of recent times.

"The curative factors found in the apple need not be limited to children exclusively. Evidence is accumulating to the effect that adults suffering from such conditions as ulcerative colitis may be cured by the use of apple pomace or apple powder. . . ."

Doctor Manville explains "the only sugar which the body is capable of using is glucose. If other sugars are fed, they must first be converted

to glucose before they can be used. This process of conversion (internal) requires time. This element of time is an important factor in conditioning the degree to which a certain amount of sugar may be utilized by the body. . . . For this reason the Germans have classified fruits and vegetables according to their ability to supply sugar and at the same time not increase the concentration of sugar in the blood to such a degree that the excess would be eliminated in the urine. . . . Apples, beets, peaches and nuts were found to have the highest value; pears, bananas, oranges and grapes were intermediates; while low values were assigned to apricots, currants and figs. . . ."

Apples are a source of vitamins A and C, although the vitamin potency varies with different varieties. Manville says: "It is the common belief that oranges are a good source of vitamin A, yet Sherman assigns to them a value of only 20 units (per ounce). There are several varieties of apples that exceed this value by more than 50 per cent.

"I believe that the great increase in incidence of respiratory infections which occur in the first three months of the year can be explained to a very large extent to the depletion of vitamin A reserves—results that are built up during the spring and summer by eating those foods which make their appearance during these seasons," said Dr. Manville.

"If an amount of diphtheria toxin which in itself is capable of killing a guinea pig is administered along with a few milligrams of crystalline vitamin C, no fatality results. The admixture of vitamin C with several lethal doses of diphtheria toxin converts the latter into a harmless product."

Enough! No more proof is needed! Let us eat apples and be healthy.

Editor's Note: The address freely referred to by Mr. Skeffington is, "New Developments in Nutritional Value of Apples as the Result of Research and Clinical Experience," by Dr. Ira A. Manville, M. D., Ph. D., Clinical Instructor in Medicine and Director of the Nutritional Laboratory, University of Oregon School of Medicine, Portland, Oregon. The address was delivered recently at the 41st annual Convention of the International Apple Association at Boston, Massachusetts. Many of our members should be able to use important points in this article in their local publicity and sales programs.

1936 LIST OF INDIANA NURSERYMEN

Name Address	Cert. No.	Stock Grown	Acres
Alameda Gardens, Plymouth	178	Ornamentals and Strawberry Plants	½
Aleon, Mrs. J. W., Evansville	45	Peonies	5
Allen, J. C., Terre Haute	62	Perennials	¼
Allen Nursery, LaPorte	483	Ornamentals, Evergreens and Shade Trees	7
Allenback Nursery, New Buffalo, Mich.	196	Berry Plants	10
Allison, Homer G., Columbus	306	Raspberry Plants	¾
Anderson, J. Cliff, Terre Haute	64	Perennials	½
Anderson, Mrs. Leonard, Chesterton	322	Perennials and Evergreens	⅜
Alstott, J. W., Corydon	34	Apple Trees	⅛
Anson, Mrs. Etta M., Sellersburg	529	Dahlias, Gladiolus and Tuberoses	6
Arford, Rollan D., Odon	100	Strawberry Plants	3
Armantrout, Perry E., Frankfort	361	Dahlias	¼
Armstrong Nursery, Evansville	29	General	16½
Aster Farm Nursery, Michigan City	563	Gladiolus and General	8
Auburn Nursery, Auburn	480	General	5
Bachelor Fruit Farm, Angola	557	Raspberry and Strawberry Plants	12
Backwater Gardens, Pierceton	184	Berry Plants	1
Baker, H. J., Worthington	9	Delphiniums, Lilies and Perennials	¼
Baker Peony Gardens, Kendallville	513	Perennials	8
Baker Rose Gardens, Indianapolis	348	Roses	¼
Balcom Nursery, Kokomo	551	General	3½
Balentine, Oliver, Pekin	243	Black Raspberry Plants	2
Barber, L. C., Washington	104	General	4
Baur-Steinkamp & Co., Indianapolis	252	Greenhouse Stock	100,000 Sq. Ft. Glass
Beal, Geo. E., Ramsey	470	Dahlias	⅛
Beal, Joe, Ramsey	462	Dahlias	⅛
Beck, Len, Lebanon	498	Shade Trees	1
Beckett Iris Gardens, Richmond	130	Iris	¼
Bro. Bede, C. S. C., Notre Dame	426	Perennials	¾
Beebe Gladiolus Gardens, South Bend	539	Gladiolus	4
Beechy, Mrs. Jessie, Goshen	222	Dahlias	¼
Bellanger, David, Crown Point	310	Ornamentals and Perennials	1¼
Bennett, R. A., Grandview	52	Strawberry Plants	3
Bennett's Nursery, Lafayette	501	General	7
Bent, Herman, Union Mills	373	Berry Plants	2
Berkey, Wilbur H., Goshen	533	Gladiolus	3
Bertermann Bros. Co., Indianapolis	449	Ornamentals and Greenhouse Stock	4
Betz, Frank S., Nursery, Hammond	385	Ornamentals	12
Beverly Greenhouse & Nursery, Ft. Wayne	278	General	3
Bieberich, Otto, Decatur	158	Berry Plants	6¼
Bigler, John, Middlebury	325	Berry Plants and Apple Stock	3
Birchmont Gardens, Cambridge City	132	General	5
Blankenbaker, Ward, Borden	235	Strawberry Plants	3
Bocard's Highland Dahlia Gardens, Depauw	460	Dahlias	1½
Bohne Bros., Indianapolis	543	Greenhouse Stock	35,000 Sq. Ft. Glass
Boyd Hort. Farm, Plainville	98	Strawberry Plants	2
Boykin's Nursery, Vincennes	15	General	4
Brazil Dahlia Farms, Indianapolis	345	Dahlias and Cannas	13
Bredeweg, Mrs. Lillie M., Shelburn	466	Perennials	⅛
Bremen Nursery, Bremen	297	Ornamentals	4
Brems, Chas., Knox	381	Ornamentals and Berry Plants	3½
Brems Co., Otto, Knox	380	Ornamentals and Berry Plants	4
Brindley, Mrs. A. F., Bristol	109	Strawberry Plants and Perennials	1¼
Brook Gardens, Goodland	301	Perennials	5
Broshears, Porter, Boonville	21	Fruit Trees	2
Brown, James H., Logansport	86	Strawberry Plants	⅛
Buckingham, Clayton, Union City	422	Ornamentals and Shades	½

Name	Address	Cert. No.	Stock Grown	Acres
Bunch, J. C.,	Terre Haute	60	General	4
Burkhart, Edw.,	Indianapolis	19	General	4
Burkhart's Nursery,	Indianapolis	414	General	40
Burns City Nursery,	Burns City	296	General	30
Burt, Fon,	Boswell	77	Ornamentals and Gladiolus	1¼
Burtsfield, F. E.,	W. Lafayette	39	Evergreens	¼
Byers, Mrs. Stella,	Onward	88	Iris	¼
Bywater, Fletcher,	Pekin	167	Strawberry Plants	1½
Bywater Nursery,	Borden	281	Fruit Trees and Ornamentals	2
Cadwell, Ray,	LaPorte	368	Berry Plants	1½
Cambridge City Nurseries,	Cambridge City	134	Evergreens	1½
Campbell, A. G.,	Crawfordsville	260	Ornamentals	¼
Campbell, Manse,	Borden	213	Strawberry Plants	5
Carlson, Alexander,	LaPorte	371	Red Raspberry Plants	1
Carper, C.,	Indianapolis	349	Ornamentals	1
Chapman, Oral,	Washington	103	General	5
Charles, H. M.,	Logansport	87	Raspberry Plants	2½
Christiana Landscape Nursery,	Elkhart	53	General	3
Churchill, G. W.,	Depauw	43	Red Raspberry Plants	1
Clarksburg Dahlia Gardens,	Clarksburg	326	Ornamentals and Dahlias	4½
Clayton, C. L.,	Oakland City	485	General	½
Coats, Ernie,	Borden	164	Strawberry Plants	1¼
Coats, Lewie,	Borden	287	Strawberry Plants	2
Coles, W. W.,	Kokomo	357	Evergreens, Perennials and Cannas	½
Colglazier, Adelbert,	Salem	400	General	¾
Colglazier, Walter,	Salem	401	General	¼
Columbia Nursery,	Evansville	188	General	3
Colvin, I. M.,	Princeton	467	Dahlias	½
Conrad, M. A.,	Goshen	566	Gladiolus	2
Cook, Geo. Clark,	Paoli	30	Strawberry Plants	2
Cook, Paul H.,	Bluffton	4	Iris and Hemerocallis	5
Coulter, Roy H.,	Westville	91	Evergreens and Perennials	½
Country Club Nursery,	Lebanon	263	General	12
Courtwright, W. C.,	Shoals	99	Strawberry Plants	2
Craun, W. R.,	Angola	392	Shade Trees, Ornamentals and Strawberry Plants	¾
Crawford, Mrs. Anna,	LaPorte	506	Ornamentals and Perennials	2
Crawford Gardens,	LaPorte	276	Ornamentals	7
Crescent Landscape Nurseries,	Evansville	491	General	5
Cress, Sidney,	Marion	124	General	1½
Crooks, Robt. M.,	Terre Haute	65	Perennials	¼
Crosby, A. H.,	New Buffalo, Mich.	376	Berry Plants	5¼
Crowe, Dennis,	Borden	402	Strawberry Plants	1½
Cunningham Gardens,	Waldron	276	Perennials	20
Curtis, D. R.,	Indianapolis	548	Dahlias	¼
Cuttriss, H. J.,	Kokomo	546	Perennials	1
Dankert, Edward,	LaPorte	374	Berry Plants	1
Danner, V. E.,	Chesterton	424	Strawberry Plants	2½
Davis, H. W.,	Rushville	11	General	1
Davis, L. E.,	Crown Point	312	Perennials	2½
Davis, Vern R.,	Newcastle	111	Perennials	¼
Decker Peony Farm,	Vincennes	486	Peonies	15
DeHoff, Gerry,	Kendallville	561	Gladiolus	7
Delight-U-Gardens,	Indianapolis	364	Dahlias	2½
DeWitt, Chas.,	Paoli	49	Strawberry Plants	1¼
Dickey, Mrs. E. C.,	Richmond	126	Dahlias	¼
Doehrmann, Martin H.,	Ft. Wayne	303	Evergreens	4
Doelling, A. G. & Son,	Valparaiso	412	Ornamentals and Perennials	1½
Doll, Fred,	New Buffalo, Mich.	369	Berry Plants	1¼

Name	Address	Cert. No.	Stock Grown	Acres
Donaghy, C. B.,	Ossian	509	Shades and Evergreens	½
Durham, George,	Pekin	241	Strawberry Plants	¾
Durham, Peck,	Pekin	161	Raspberry and Blackberry Plants	1¼
Eagle Creek Nursery Co., Inc.,	New Augusta	253	General	40
Eaton, John L.,	Burns City	95	Strawberry Plants	¼
Edgewater Nursery,	Goshen	323	General	8
Edwards, R. G.,	Plainfield	499	Strawberry Plants	12
Elliot, M. E.,	Terre Haute	63	Perennials	¼
Elnora Nurseries,	Elnora	96	General	10
Elwood Nursery,	Elwood	437	General	2½
Erie Gardens,	North Manchester	267	Perennials	1
Ernst Nursery,	Muncie	503	General	10
Evans, Earl E.,	Ft. Wayne	37	Ornamentals	½
Evans, Sherman,	Edinburg	307	Strawberry Plants	¼
Eyer, Oliver,	Goshen	224	Strawberry Plants	½
Fairview Fruit Farm,	Pierceton	500	Berry Plants	17
Fairview Nursery, Inc.,	Ft. Wayne	428	General	3
Falls City Gardens,	Pendleton	112	General	4
Felton, L. D.,	Mooreland	261	Ornamentals and Perennials	½
Fisher, David,	Borden	190	Strawberry Plants	3
Fisher, Everett,	Odon	102	Berry Plants	1½
Fisher, Palmer,	Borden	191	Strawberry Plants	1
Fisk, Mrs. Will,	Crawfordsville	131	Aquatic Plants	1/10
Flory, C. A.,	Logansport	248	Berry Plants	3¼
Flory, Jasper,	Logansport	90	Raspberry Plants	3½
Flory, Schuyler,	Logansport	89	Berry Plants	4½
Fohl's Pansy Gardens,	Indianapolis	354	Perennials	1
Forbes & Sons, J. H.,	Vincennes	258	General	4
Fordyce, Fred,	Borden	210	Strawberry Plants	3
Fordyce, Millard,	Pekin	168	Strawberry Plants	2
Fossenkemper, R. M.,	Richmond	523	Dahlias and Gladiolus	¼
Fox, Martin,	Mitchell	32	Raspberry Plants	1½
Fox Nursery,	Elkhart	302	Perennials and Rock Garden Plants	4
Frank & Sons, W.,	Portland	558	Greenhouse Stock	80,000 Sq. Ft. Glass
Frye Nursery,	Lafayette	474	General	6
Fulhart Nursery, L. L.,	Muncie	496	General	8
Gainey & Sons, S. C.,	Scotland	249	Ornamental Shrubs	¼
Garber, Dan,	Pierceton	183	Strawberry Plants	3
Gardner, Will,	Spiceland	133	Evergreens	1
Gaylord, Fred J.,	Lafayette	38	Evergreens and Perennials	1½
Geutall, J.,	Indianapolis	352	Shade Trees and Ornamentals	1
Gloy, Carl,	New Buffalo, Mich.	204	Strawberry Plants	1
Graham Nursery,	Jeffersonville	450	General	3
Grande, Edward C.,	Indianapolis	490	Greenhouse Stock	17,500 Sq. Ft. Glass
Grass, G. A.,	Troy	18	Apple and Grape Stock	¼
Grassyfork Fisheries, Inc.,	Martinsville	117	General	10
Gray, Carl M.,	Petersburg	464	Dahlias	3
Gray, J. M.,	Ewing	245	Peach and Strawberry Plants	4¾
Green, Mrs. Cleve,	Milltown	469	Dahlias	⅛
Green, Henry J.,	Milltown	41	Fruit Trees	¼
Grill's Peony Field,	Hagerstown	305	Peonies	2¾
Grimes, W. H.,	Kendallville	560	Gladiolus	5
Groff Flower Shop,	Lakeville	386	Perennials	½
Gropp, Fred,	LaPorte	375	Berry Plants	2
Groshon, E. F.,	Angola	393	Red Raspberry Plants	2½

Name	Address	Cert. No.	Stock Grown	Acres
Gumm's Peony Gardens, Remington		75	Evergreens and Perennials	9
Guntle, O. A., Frankfort		263	Dahlias	½
Haas Home Nursery, Terre Haute		411	General	30
Hallowell Nursery, Pendleton		518	General	4
Hamacher, J. C., Hammond		425	General	5
Hammill, Will., and Ed. Heacock, Warsaw		187	Strawberry Plants	⅛
Hanka, Earl, Borden		273	Berry Plants	2
Hansel, Jonathan, Fillmore		68	Grapes	¼
Harder, H. J., Hammond		321	Ornamentals and Perennials	4
Harmon Nursery, Atwood		502	General	4½
Hart's Nursery, Spencerville		568	General	18
Harrell Floral Gardens, Wabash		31	Perennials, Iris and Peonies	1
Hausen, John, Knox		70	Strawberry Plants	2
Hayne's Plant & Berry Farm, Hartford City		283	General	4
Hazen Home Nursery, Hatfield		44	General	6
Hein, Matthias, Pekin		93	Berry Plants	1½
Heller Bros. Co., Newcastle		429	Greenhouse Stock	70,000 Sq. Ft. Glass
Helmuth, Henry J., Evansville		304	Peonies	5
Henderson Botanical Gardens, Greensburg		12	Wildflowers and Medicinal Plants	¼
Henley, R. M., Hartford City		186	General and Greenhouse Stock	1½ 50,000 Sq. Ft. Glass
Henley Bros., Terre Haute		67	General	1
Henning, Paul T., Stendal		23	Iris	⅛
Herd, Thomas, Kewanna		383	Strawberry Plants	1½
Highland Nursery, Evansville		22	Evergreens, Shrubs and Shade Trees	1½
Highland Nursery, South Bend		448	Shades and Ornamentals	4
Hill Floral Products Co., Richmond		127	Greenhouse Stock	1,300,000 Sq. Ft. Glass
Hillcrest Orchards, Mt. Vernon		13	General	¼
Hillsdale Gardens, Logansport		493	General	15
Hillsdale Nursery, Indianapolis		433	General	60
Hill's Nursery, Bristol		108	Perennials	4
Himsel, Ed., Jasper		20	Evergreens	1½
Hirt, B. D., Winamac		80	Strawberry Plants	1
Hobbs' C. M. Sons Co., Bridgeport		290	General	360
Hobson, Alva, Pekin		239	Strawberry Plants	3½
Hoffman Gardens, Wabash		47	Perennials, Iris and Peonies	¾
Hoffman, J. A., Marion		122	Ornamentals	¾
Holmes, Daisy M., Camby		141	Raspberry Plants	½
Home Nursery, Newcastle		137	General	3
Hood's Nursery, Osceola		489	General	20
Hopkins, V. V., Rensselaer		442	General	2
Horton, Mrs. Norman S., Elkhart		334	Perennials	1
Hosler, Clarence, Grabill		147	Raspberry Plants	1¼
Houchin, C. A., Petersburg		465	Dahlias	⅛
Houchins, T. R., Crown Point		565	Gladiolus and Dahlias	¼
Hough, A. N., New Albany		454	Dahlias and Gladiolus	¾
Huber, Anna, Borden		212	Strawberry Plants	1¾
Huckleberry, Warren, North Vernon		10	Evergreens, Ornamentals and Greenhouse Stock	½ 14,000 Sq Ft. Glass
Huffer, John W., Plymouth		268	Berry Plants	3
Hughel Gardens, Indianapolis		346	Perennials	1
Hunsucker, Hubert, Vallonia		259	Shades and Ornamentals	2
Hunt, Mrs. Ray, Mishawaka		477	General	8
Hunter, Glenn, DeMotte		379	Ornamentals and Raspberry Plants	2¾
Hurst, Dennis, Pekin		300	Strawberry Plants	3½
Hurst, Virgil, Borden		233	Strawberry Plants	1¼

Name	Address	Cert. No.	Stock Grown	Acres
Ideal Acres, South Bend		315	Strawberry Plants	3½
Indianapolis Aquatic Plant Co., Indianapolis		353	Aquatic Plants	¼
Indiana Landscape & Nursery Co., Darlington		136	General	1
Indiana Nursery Co., Coal City		69	General	7
Irwin, Dr., Summitville		118	Evergreens	¼
Ireland, Chas., Brownstown		246	Strawberry Plants	¼
Jackson, Dempsey, Borden		165	Strawberry Plants	1½
Jackson, Ham., Borden		163	Strawberry Plants	⅛
Jackson, Raymond, Borden		160	Strawberry Plants	3
Jacobi, L. C., Floyd Knobs		230	Berry Plants	2
Jasch, Wm., Michigan City		194	Evergreens	1
Johnson, Delbert, Borden		218	Strawberry Plants	¾
Johnson, T. C., Logansport		504	Evergreens	¼
Johnson, Wash., Borden		219	Strawberry Plants	2
Judson, Victor, Bristol		107	Berry Plants	28
Judy, Maynard, Goshen		556	Gladiolus	2
Julius' Sons, J., Jeffersonville		407	Evergreens	¼
Kaiser, H. J., Seymour		443	Berry Plants	3
Keach Nurseries, Richmond		285	General	5
Kircher, W. W., Goshen		223	Berry Plants	6
Killingbeck Nursery, Michigan City		193	Ornamentals and Perennials	½
Kime's Nursery, Denver		84	Strawberry Plants	4
Kindig, B. F., Shipshewana		389	Perennials	1½
Kirkham Nursery, Muncie		440	General	3
Kirtley, J. E., Borden		159	Red Raspberry Plants	¾
Klinefelter, A. B., Atwood		272	Perennials	¼
Knapp, Dr. A. J., Evansville		250	Peonies	60
Knipe, Tom, Kokomo		554	Evergreens and Perennials	2
				22,500 Sq. Ft. Glass
Knox Nursery & Orchard Co., Vincennes		3	General	5
Kokomo Dahlia Gardens, Kokomo		358	Dahlias	4½
Kooy, John G., DeMotte		71	Shade Trees	1
Kotwica, Ludwig, New Buffalo, Mich.		207	Strawberry Plants	1
Kreiger, Mrs. Chris., Argos		174	Peonies	½
Krider Nurseries, Inc., Middlebury		251	General	225
Krueger, Edwin H., LaPorte		367	Strawberries	2¼
Kuebler Greenhouse, Evansville		570	Greenhouse Stock	10,000 Sq. Ft. Glass
Kunderd, Inc., A. E., Goshen		397	Gladiolus, Ornamentals and Perennials	150
Kunderd, E. J., New Haven		567	Gladiolus	14
Kunderd, Robert J., Goshen		535	Gladiolus	1½
Kunzman Dahlia Gardens, New Albany		453	Dahlias and Cannas	15
Lafayette Nursery, Lafayette		484	General	4½
LaHayn, William, Chesterton		495	General	3
Lake, F. M., Spencerville		332	Strawberry Plants	¼
Laketon Nurseries, Laketon		286	General	30
Landis, Moyne, Pierceton		185	Strawberry Plants	¼
Landrum, Mrs. H. F., Bunker Hill		40	House Plants	
Landscape Gardening Co., South Bend		446	General	7
Lane, S. S., Rosedale		473	Strawberry Plants	2½
Lausten, James, Knox		452	Red Raspberry and Strawberry Plants	1½
LeMasters, Mrs. Elda, Albion		338	Iris	⅛
Leutheart, John, Floyd Knobs		405	Raspberry Plants	1½
Lewis Nursery, Fairmount		280	General	3½
Liberty Highway Nursery, Walkerton		434	General	5
Linberg, Gilbert, New Buffalo, Mich.		205	Strawberry Plants	1

Name	Address	Cert. No.	Stock Grown	Acres
Linderman, David,	Chesterton	292	General	35
Linton's Dahlia Gardens,	Brazil	342	Dahlias	4
Little Tree Nursery,	Marion	432	Ornamentals and Perennials	1
Llewellen, Albert,	Pekin	481	Strawberry Plants	1
Lloyd's Gladiolus Gardens,	Bremen	542	Gladiolus and Perennials	5
Logsdon, Sam E.,	Hebron	319	Ornamentals and Perennials	10½
Lone Elm Peony Farm,	Indianapolis	436	Perennials and Peonies	2
Long, Tom A.,	Elnora	101	Berry Plants	2½
Longfield Iris Farm,	Bluffton	1	Iris, Peonies and Hemerocallis	7
Losson, Dennis,	Pekin	169	Strawberry Plants	1
Lubke, Edw. L.,	New Buffalo, Mich	57	Fruit Trees and Berry Plants	2
Lucas, J. W.,	Bloomfield	94	Evergreens	½
Lucky Gardens,	Knox	540	Perennials, Gladiolus and Dahlias	2
Luther Bros.,	Albion	337	Strawberry Plants	2
Lutz, Philip, Jr.,	Boonville	2	Peonies	60
Lycan, Henry,	Anderson	418	General	1½
McCaslin, John A.,	Franklin	423	Ornamentals and Perennials	¼
McClellan, A. S.,	Whiteland	220	Shades and Ornamentals	½
McCollum, Mrs. A. L.,	Acton	17	Rock Garden Plants	¼
McCoskey, W. S.,	Pekin	240	Red Raspberry and Strawberry Plants	3
McCoy, Harry,	Troy	28	General	¼
McCracken, Mrs. Rose,	Jeffersonville	409	Ornamentals	¼
McDonald Co.,	Crawfordsville	479	General	2
McFadden, Clarence,	Boswell	76	Gladiolus and Dahlias	½
McFeron Fruit & Nursery Co.,	Columbus	325	Strawberry Plants	2½
McGowan, Mrs. Maurice R.,	Anderson	116	Rock Garden Plants and Perennials	¼
McKinley, Bruce,	Borden	231	Strawberry Plants	1
McKinley, George,	Borden	430	Strawberry Plants	1¼
McKinley, Gobel,	Borden	519	Strawberry Plants	¾
McMahan, Robt. L.,	Crown Point	309	Ornamentals	¾
McNeil, R. H.,	Granger	318	Strawberry Plants	1½
Mack, Mrs. Forest,	Hillsdale	515	Perennials	½
Mackenzie, A. W.,	Indianapolis	419	Iris and Hemerocallis	½
Maerz, Fred,	LaPorte	208	Strawberry Plants	½
Mahuron, Gilbert,	Pekin	162	Red Raspberry Plants	¼
Malone, Mrs. Omega,	Borden	209	Perennials and Dahlias	¼
Manchester, C. N.,	Rochester	74	Strawberry Plants	⅛
Manley, Donald,	Elkhart	536	Gladiolus	6
Maple View Farm,	Plymouth	177	Perennials	2
Markland, M.,	Indianapolis	351	Dahlias	½
Marlette, J. H.,	Evansville	14	General	3½
Marsh, E. A.,	Plymouth	179	Berry Plants	1½
Martin, Harry,	Borden	214	Strawberry Plants	3
Martin, Peter,	Borden	247	Strawberry Plants	1
Martin, T. S.,	Borden	211	Strawberry Plants	1¼
Maschmeyer, Edw.,	Indianapolis	366	General	8
Masek, Ben. J.,	Wanatah	255	Peonies	2
Mathew's Manor,	Winamac	384	General	12
Maudlin, A. C.,	Campbellsburg	398	Strawberry Plants	1
Maurer, Albert,	North Manchester	294	Strawberry Plants	½
Mayfield, Robt.,	Whiteland	221	Perennials	⅛
Mayflower Nursery,	LaPorte	284	General	5
Mazac Bros. Nursery,	New Buffalo, Mich.	195	Strawberry Plants	2
Mazelin, Dan,	Berne	155	Raspberry Plants	¼
Mazelin, David J.,	Berne	154	Raspberry Plants	⅛
Meade, Mrs. Franklin B.,	Ft. Wayne	478	Iris and Peonies	½
Meeker, H. Josephine,	Crown Point	516	General	5
Meier, H. W.,	Evansville	51	Peonies	12

Name	Address	Cert. No.	Stock Grown	Acres
Melick, Frank, Spencer		341	Greenhouse Stock	2
				8,000 Sq Ft. Glass
Merchants Trust & Savings Bank, Muncie		119	Evergreens	30
Meredith, J. O., Marion		121	Ornamentals and Shades	1
Meyers, Maurice, LaPorte		459	Strawberry Plants	½
Midwest Evergreen Gardens, Muncie		413	General	15
Midwestern Landscape Co., Anderson		238	General	2
Miller, A. D., Cannelton		42	Strawberry Plants	½
Miller, Arthur, Borden		441	Strawberry Plants	5
Miller, Edgar M., Linton		7	Ornamentals and Evergreens	½
Milligan Cut Rate Nurseries, Terre Haute		66	Shades and Ornamentals	5
Minor, Alfred F., Indianapolis		355	Shades and Ornamentals	½
Mitterling, S. J., Goshen		110	Berry Plants	1⅛
Moldenhaur, C. J., Huntington		144	Ornamentals	¾
Moolenaar Bulb Farm, DeMotte		473	Tulips and Narcissus	3
Moore, F. E., Fort Wayne		420	General	½
Moore, Lee, Akron		415	Perennials	1
Mufich, Emil, New Buffalo, Mich.		206	Strawberry Plants	1
Nappanee Evergreen Nurseries, Nappanee		271	Ornamentals	2
Naville Bros., Floyd Knobs		229	Berry Plants	2¾
Neff, Mrs. Walter, Delphi		78	Perennials and Wildflowers	⅛
Nelson, Frank, Columbus		324	Raspberry Plants	2
Nicholson, Zack, Borden		232	Strawberry Plants	1
Nicklin, Ephriam, New Buffalo, Mich		203	Strawberry Plants	3½
Nussbaum, S. D., Monroe		153	Raspberry Plants	¼
Nye, J. L., Ft. Wayne		299	General	2½
Oler, Mrs. Claude, Richmond		120	Dahlias	½
Old Capital Nursery, Corydon		461	Dahlias	⅛
Oplinger, Mrs. Grover, Walkerton		311	Perennials	1
Osborn, Matt., Centerville		129	Evergreens	1
Otto & Sons, A. J., Hobart		421	General	5
Overholzer, Dr. W. L., Winamac		73	Strawberry Plants	¾
Overman, Edward, Jonesboro		266	Strawberry Plants	¼
Packwood, Mrs. M. E., Borden		456	Dahlias	⅛
Paul Dresser Gardens, Attica		427	Ornamentals and Perennials	1
Payne, Gavin L., Indianapolis		298	Chinese Elms	10
Payne's Landscape Company, Terre Haute		59	General	11
Paynter, Dr. W. L., Salem		457	Dahlias and Gladiolus	2½
Peed, Albert O., Mitchell		475	Strawberry Plants	½
Pentecost, P. J., Tipton		497	Gladiolus and Perennials	25
Pickrell's Nursery & Floral Gardens, Elkhart		335	Shades, Ornamentals and Greenhouse Stock	2
Pixley, John, Pekin		492	Strawberry Plants	½
Plahetka, Geo. Wm., New Buffalo, Mich.		201	Evergreens and Strawberry Plants	½
Pleiss Gardens, New Albany		417	Greenhouse Stock	1
				15,000 Sq. Ft. Glass
Pletcher, Floyd, Goshen		388	Lilies	¼
Pluska, M., New Buffalo, Mich.		199	Strawberry Plants	½
Porter, Tompie, Borden		171	Strawberry Plants	1½
Price, Mrs. Walter, Plymouth		176	Strawberry Plants	½
Princeton Nurseries, Princeton		274	General	15
Pullin, W. H., Rensselaer		72	General	1
Rainbow Flower Gardens, Huntington		552	Gladiolus	1
Rainbow Water Gardens, Cambridge City		128	Aquatic Plants	¼
Rassmussen, A., & Son, New Albany		454	Greenhouse Stock	275,000 Sq. Ft. Glass
Rathbun Nurseries, Angola		505	General	3
Ray, Mrs. Cortis, Greensburg		328	Perennials and Dahlias	½

Name	Address	Cert. No.	Stock Grown	Acres
Ray, Joie, Gary		517	General	4¼
Reed's Nursery, Madison		269	General	2
Reese, R. R., Plymouth		182	Berry Plants	2½
Rehm, Howard F., Westville		56	Ornamentals and Strawberry Plants	1¼
Reiman's Nursery, Vincennes		279	General	10
Rempa, George, Michigan City		200	Strawberry Plants	1
Renicker, John, North Manchester		173	Raspberry Plants	⅓
Rettic Nursery, South Bend		438	General	1¼
Rhinehardt, John C., Evansville		25	Iris	1
Rhodes, A. N., Newcastle		494	Genera	5
Rice Bros. Nursery, Rensselaer		275	Shade Trees	5
Richer, Mrs. J. M., South Whitley		295	Iris and Peonies	½
Rickard, C. C., Pekin		236	Ornamentals	⅛
Riedel, J. M. E., Ft. Wayne		36	Iris and Peonies	½
Rimmel, R. T., Albion		336	Raspberry Plants	2½
Ripley, George, LaPorte		46	Perennials, Iris and Peonies	½
Riverside Plant and Fruit Farm, Orland		395	Strawberry Plants	¾
Robinette Nursery, Lafayette		262	General	10
Roby, Mrs. Geo. L., Fowler		254	Perennials	4
Rodger, Bennett, Orland		394	Strawberry Plants	2
Roerk, W. H., Borden		189	Strawberry Plants	¼
Ross, Mrs. Clara, Jeffersonville		403	General	¼
Rugenstein, John A., Indianapolis		365	Dahlias	½
Rust Nursery, Henry, Crown Point		445	Ornamentals and Perennials	6
Sarkey, M. A., Gary		320	General	2½
Sawyer, Wm., North Manchester		172	Raspberry Plants	⅛
Schakel, H. A., Indianapolis		16	Evergreens	¼
Schlemmer, Ed., Wabash		468	Dahlias	⅛
Schneck, Geo., Granger		382	Berry Plants	4
Schrock, N. N., Berne		150	Raspberry Plants	⅛
Schuell, Franklin, South Bend		439	General	4½
Scholtz, John, LaPorte		387	Berry Plants	3
Schwartz, J. D. R., Monroe		152	Raspberry Plants	½
Schwartz, Jacob J., Berne		148	Raspberry Plants	¼
Scott, Harry, Borden		228	Strawberry Plants	2
Seal Gardens, Columbus		410	Ornamentals and Perennials	2
See, Elmer, Anderson		114	Evergreens and Dahlias	¾
Seybert, Ernest, Pendleton		113	Fruit Trees	¼
Shake, Charles, Indianapolis		436	Shades and Ornamentals	2
Shawala, Martin, New Buffalo, Mich.		198	Strawberry Plants	1
Shearer, Wm. F., Angola		541	Peonies and Gladiolus	8
Sheely, Wm., Auburn		330	Perennials, Dahlias and Gladiolus	¼
Shepherd, Wilbur, Churubusco		508	Berry Plants	2
Shippee, Bert, LaPorte		372	Red Raspberry Plants	2
Shultz, C. E., LaPorte		370	Berry Plants	¾
Shumaker, Carl, Angola		391	Evergreens, Perennials and Red Raspberry Plants	¾
Shuman, Earl, Angola		487	Berry Plants	3¼
Silver Glenn Nursery, Plymouth		180	Ornamentals and Strawberry Plants	½
Simpson Landscape Co., Tippecanoe		511	General	3
Simpson Outdoor Art Co., Columbus		289	General	¾
Slater, Bert, LaPorte		58	Strawberry Plants	¼
Smith, Charles, Borden		227	Strawberry Plants	2
Smith, Hugh E., Kokomo		550	Strawberry Plants and Perennials	¾
Smith, J. E., Muncie		339	General	½
Smith, Lewie, Borden		217	Strawberry Plants	2
Smith, Manuel, Paoli		54	Strawberry Plants	1½
Smith, Mrs. Marion T., Terre Haute		61	Perennials	¼
Smith, Noah, Floyd Knobs		406	Strawberry Plants	1
Smith, Wm. Grant, Delphi		256	Perennials	¼

Name	Address	Cert. No.	Stock Grown	Acres
Smith, W. H.,	Floyd Knobs	404	Raspberry Plants	1¼
Smolenski, Horst,	Indianapolis	416	Ornamentals, Shades and Perennials	1
Snider, L. H.,	Auburn	106	Strawberry Plants	1¾
Solner, Andrew,	New Buffalo, Mich	197	Strawberry Plants	1
Sparks, Mrs. Raymond,	Columbus	471	Dahlias	4
Stembel, Chas. K.,	Boswell	282	Perennials and Gladiolus	3
Steury, Dan P.,	Berne	156	Raspberry Plants	½
Steury, David P.,	Berne	149	Raspberry Plants	⅛
Steury, Rudolph,	Monroe	151	Raspberry Plants	⅛
Stevens, Ade O.,	Depauw	476	Raspberry Plants	1
Stevenson, Addison,	Knox	555	Perennials and Gladiolus	2
Stewart, Mrs. T. I.,	Portland	145	Perennials	½
Stewart, J. W.,	Fruitdale	270	Black Raspberry and Blackberry Plants	1
Stout, Floyd,	Indianapolis	343	Strawberry Plants	¼
Stradtner, Wm. P.,	Michigan City	192	Strawberry Plants	1
Strohl's Nursery,	Ft. Wayne	50	Shades, Evergreens and Ornamental Shrubs	4½
Sturm, C. C.,	Elizabeth	444	General	3
Sumava Resorts Nursery,	Sumava Resorts	431	General	1
Sunnyview Gardens,	Indianapolis	559	Gladiolus and Perennials	1
Sunrise Glad Gardens,	Bippus	553	Gladiolus	1
Swaim & Son,	South Bend	314	Perennials	1½
Sweet, Inc., Geo. A.,	Ft. Wayne	105	Evergreens	3½
Sylvan Gardens,	Anderson	115	Perennials and Rock Garden Plants	½
Taggart, E. W.,	Peru	82	Berry Plants	4
Talbott, John E.,	Linton	8	Ornamentals, Evergreens and Shade Trees	½
Taylor, Elmo,	Orland	396	Strawberry Plants	2
Teaford, Lee,	Paoli	55	Strawberry Plants	2
Templeton, Mrs. Lola,	Sullivan	5	Perennials	¼
Terrill, Grover,	Pekin	166	Strawberry Plants	1
Terrill, Halley,	Pekin	242	Strawberry Plants	½
Teuchert's Glad Farm,	Goshen	534	Gladiolus	70
Thimlar Nursery,	Ft. Wayne	264	Ornamentals and Perennials	5½
Thomas, W. H.,	Logansport	85	Strawberry Plants	1¼
Thornburg Nursery,	Evansville	48	General	19
Thralls, Mrs. L. H.,	Hymera	6	Columbine and Perennials	¼
Tippecanoe Gardens, W.	Lafayette	257	Peonies, Iris and Perennials	1
Todd, Floyd,	Borden	234	Strawberry Plants	1
Toothaker, A.,	South Bend	316	Shade Trees, Ornamentals and Perennials	¾
Traster, D. S.,	Fairmount	265	General	¼
Travis, Mrs. Calvin,	Plymouth	181	Berry Plants	1
Trine, Harry,	Fortville	514	Ornamentals	¼
Troth, R. A.,	Orleans	512	General	5
Trowbridge, Eugene,	Mishawaka	399	Perennials	4
Troyer, C. E.,	LaFontaine	562	Gladiolus	3
Tuckdawa Gardens,	Peru	340	Perennials, Iris and Peonies	3
Tudor Gardens,	Zionsville	549	Dahlias and Perennials	1½
Twin Cedar Nursery,	Georgetown	451	General	5
Twin Hills Nursery,	Terre Haute	142	Raspberry Plants	1
Tyler, A. I.,	Cambridge City	135	Evergreens	¼
Unger, Mrs. F. C.,	Ridgeville	125	Iris	¼
Valley View Nursery,	Martinsville	140	General	6
Van Winkle, Lewis,	Granger	291	Shades and Ornamentals	2
Van Wyngarden Bros.,	Lowell	308	Ornamentals and Perennials	6
Vermilya, Ray,	Brownstown	244	Strawberry Plants	⅛
Veech, Fred,	Petersburg	463	Dahlias	1
Vincennes Nursery Co.,	Vincennes	24	Cherry Trees	3
Vorhees, Cornelius,	New Buffalo, Mich.	377	Berry Plants	3¼

Name	Address	Cert. No.	Stock Grown	Acres
Wabash Valley Nursery, W.	Lafayette	510	General	24
Wade, Fred,	Borden	226	Strawberry Plants and Dahlias	1¾
Wade, Maurice,	Borden	216	Strawberry Plants	1¾
Wagner, Alfred.,	New Buffalo, Mich.	202	Strawberry Plants	1
Wakarusa Greenhouses,	Wakarusa	532	Gladiolus and Dahlias	1½
Walls, Elijah,	Paoli	520	Strawberry Plants	1½
Walton, Arnie,	Pekin	170	Strawberry Plants	¾
Walton, Frank,	Campbellsburg	488	Strawberry Plants	2
Warman Nursery,	Hammond	317	Evergreens and Perennials	1½
Washburn Dahlia Gardens,	Kokomo	359	Dahlias and Gladiolus	1
Washler, Louis,	Spencerville	333	Strawberry Plants	2½
Waverly Farm and Nursery,	Chesterton	521	General	3¼
Waynedale Perennial Gardens,	Ft. Wayne	146	Perennials	1¼
Wayside Fruit Farm,	Peru	83	Raspberry Plants	7
Wayside Gardens,	Indianapolis	347	Perennials	1½
Wayside Gardens,	Pleasant Lake	360	Dracena Indivica	2,300 Sq. Ft. Glass
Wayside Nursery,	Knightstown	356	Perennials and Evergreens	1
Wayt, Mrs. C. W.,	Lynn	522	Gladiolus and Dahlias	2
Weber Floral Co.,	Terre Haute	569	Greenhouse Stock	30,000 Sq. Ft. Glass
Webster, Mrs. Jessie C.,	Westfield	362	Perennials	¼
Weeks, Manuel,	Borden	237	Strawberry Plants	1
Westphal, Louis,	New Buffalo, Mich.	378	Berry Plants	3
Wetterlund, E. B.,	Hobart	507	Evergreens, Perennials and Berry Plants	1¾
Whicker's Nursery,	Amo	293	Strawberry Plants	4
White, Dr. A. E.,	Indianapolis	544	Dahlias	¼
White, Geo. A.,	Union Mills	238	Ornamentals and Perennials	½
White, Harry,	Winamac	81	Evergreens	½
Wible, Roy E.,	Kendallville	390	Orchids	100 Sq. Ft. Glass
Widney Orchards,	St. Joe	331	Strawberry Plants	4
Wiegand, A., Sons & Co.,	Indianapolis	564	Nursery Stock	35
Wilkinson, J. F.,	Rockport	27	Nut Trees and Narcissus	3½
Williams, Elsie and Mary,	Connersville	139	Dahlias	2
Williams, John D.,	Marion	123	Evergreens	¼
Williams, Merle,	Terre Haute	143	Raspberry Plants	1
Williams, Reginal,	South Bend	313	Perennials	1
Wilson Bros.,	Roachdale	547	Geraniums and Vincas	10,000 Sq. Ft. Glass
Wilson Dahlia Farm,	Indianapolis	344	Dahlias	2
Winks, O. L.,	Rensselaer	482	Ornamentals, Perennials and Strawberry Plants	½
Wittel, Jacob F.,	Peru	35	Grape Vines	¼
Wolverton, Mrs. L. C.,	Delphi	79	Perennials	¼
Wood, Emmett S.,	Madison	458	Perennials and Dahlias	1
Woods, A. E.,	Greenfield	92	General	¼
Woolbright, Clarence,	Odon	97	Nut Trees and Grapes	5
Worthington Gardens,	Rushville	138	Perennials	¼
Worth While Dahlia Gardens,	Kokomo	545	Dahlias	1½
Wright, Alva	Borden	215	Strawberry Plants	2¼
Wright, Harry,	Indianapolis	350	Perennials	¼
Wyatt, Raleigh,	Auburn	447	Perennials, Dahlias and Gladiolus	4
Yake, Henry,	Decatur	157	Raspberry Plants	¼
Ziegler, Mrs. John,	Greensburg	327	Dahlias	¼
Zurschmeide, Edward,	Jeffersonville	408	Strawberry Plants	4

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1935-36

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Barnes, Ralph D.....Lagrange, R. R. 2
Bartels, Herman C.....Goshen, 106 N. Eighth
Baugh, Faye.....Middlebury, R. R. 2, Box 110
Beck, Nelson H.....Elkhart, 1209 Bower St.
Bollenbacher, J. H.....Elkhart, R. R. 4
Clark, V. V.....Bristol
Cripe, Henry.....Goshen, 1509 S. Main St.
Cripe, J. S.....Goshen, R. R. 1
Daly, L. C.....Elkhart, 136 Highland Ave.
Dewart, Lester.....Syracuse, R. R. 3
Eagles, Dr. Albert E.....Wolcottville
Elkhart Truth.....Elkhart
Fidler, Richard.....Goshen, R. R. 4
Fields, Robert.....Wolcottville, R. R. 1
Fisher, Guy.....Milford, R. R. 1
Judson, Charley.....Bristol
Judson, Victor.....Bristol
Kercher, W. W.....Goshen, R. R. 5
Krause, John S.....Walkerton, R. R. 2
Lambert, O. D.....White Pigeon, Mich.
Miller, Everett.....New Paris
Miller, I. Wesley.....Goshen, R. R. 4
Miller, Jacob I.....Goshen, R. R. 5, Box 16
Miller, O. J.....Goshen, R. R. 4
Mosher, W. B.....Berrien Center, Mich.
Nymeyer, Wm. H.....Goshen, 101 S. Main
Owens, Ed. C.....Shipshewana, R. R. 2
Roderick, Ed.....Middlebury
Roderick, John E.....Middlebury, Box 48
Roose, Homer.....Goshen, 211 S. 6th St.
Stucky, Elmer.....Syracuse, R. R.
Stutzman, Ralph.....Goshen, R. R. 2
Troyer, C. C.....Lagrange, R. R. 4
Trump, George.....Middlebury, R. R. 2
Ulmer, D. P.....Wolcottville
Warner, DeMain.....Goshen, R. R. 1, Box 29 (Secretary)

Wise, Rufus.....Middlebury, R. R. 2
Yoder, Jonas.....Goshen, R. R. 1
Yoder, Levi R.....Middlebury, R. R. 1
Zigler, J. S.....Goshen, R. R. 4

Fayette County Society

Fielding, Vivan.....Connersville, 326 E. 12th St. (Secretary)
Kennedy, Dr. Fred A.....Connersville
Scholl, Geo. E.....Connersville, R. R. 9
Stephens, Mrs. O. L.....Rushville, R. R. 7

Floyd County Society

Adamson, Noah.....Georgetown, R. R. 4
Conner, S. V.....New Albany, 1309 E. Main St.
Hanka, Lawrence.....Floyd Knobs, R. R.
Knable, Alfred.....New Albany, R. R. 2
Kruer, John H.....Floyd Knobs
Libs, Andrew.....Floyd Knobs, R. R. 1
Libs, Gregory.....New Albany, R. R. 2
Little, Dr. G. N.....New Albany, Elsby Bldg.
Long, J. H.....New Albany, R. R. 3
Losson, Frank.....Floyd Knobs, R. R. 2
Moser, Ed.....Floyd Knobs, R. R. 1
Moser, Fred.....Floyd Knobs, R. R. 1
Parsons, John.....Floyd Knobs
Romann, John H.....New Albany, R. R. 1
Strassel, R. M.....Floyd Knobs, R. R. 1
Wacker, W. S.....Louisville, Ky., care of Louisville Chemical Co.
Wolfe, Claude.....New Albany, Star Route (Secretary)

Greene County Society

Bolten, Ferdinand.....Linton
Bridges, E. R.....Bloomfield
Curnutt, Homer.....Linton, R. R. 3
Gilliland, O. E.....Solsberry
Hasler, Orval.....Koleen
Hays, Marcus.....Worthington
Record, W. E.....Bloomfield, R. R. 1
Sexton, Geo. M.....Linton
Wolf, Roscoe.....Linton, R. R. 1

Johnson County Society

Billingsley, B. L.....Greenwood
Browning, Leander.....Greenwood
Faris, Ernest.....Nineveh
Gilmour, H. M.....Franklin
Heckman, Harry.....Nineveh, R. R. 1

Henderson, E. E.....Greenwood
Homell, Montie.....Franklin
Magill, H. O.....Franklin
Magill, W. W.....Lexington, Ky., Dept. of Horticulture, Univ. of Ky.
Quillen, Victor.....Trafalgar
Robison, Giles T.....Boggstown, R. R. 1
Runkle, L. W.....Edinburg, R. R. 3
Saunders, A. R.....Franklin (Secretary)
Townsend, Jess.....Franklin

Knox County Society

Brauer, Harry.....Olney, Ill., 315 Walnut St.
Buss, Walter.....Vincennes, R. R. 1
Byers, E. E.....Vincennes, R. R. 3
Chambers, Garfield.....Vincennes
Crook, Harry.....Vincennes
Dyer, John N.....Vincennes
Ebner Ice & Cold Storage Co.....Vincennes
Epler, A. E.....Keensburg, Ill.
Funk, J. W.....Vincennes, R. R. 2
Funk, Dr. V. A.....Vincennes, LaPlante Bldg.
Gerhardt, C. E.....Birds, Ill.
Gillespie, W. C.....Vincennes
Gilliatt, Dr. Floyd.....Decker
Hamilton, R. I.....Vincennes, 820 N. 5th St.
Haskins, Edgar N.....Vincennes
Hedden, Fay.....Vincennes
Hogue, R. M.....Vincennes
Junkin, W. Verne.....Vincennes
McKown, Vernon.....Vincennes, 602 S. Sixth
McDonald, Luther.....Vincennes
Martindale, W. A.....Vincennes, R. R. 2
Meyer, Carl F.....Vincennes, R. R. 7
Meyer, Orval C.....Vincennes
Nesbit, B. F.....Vincennes, 417 Buntin St.
Oexman, Walter.....Vincennes, R. R. 7
Patterson & Son, Henry.....Vincennes, R. R. 1
Pielemeier, Dr. G. A.....Vincennes, 520 Main St.
Reed, Meredith.....Vincennes, R. R. 2
Scanling, E. E.....Carlisle
Schlotter & Co., J. G.....Indianapolis, 406 S. New Jersey St.
Schulze, M. A.....Vincennes
Schultz, Louis.....Decker
Simpson Orchard Co.....Vincennes
(David Simpson, Secretary)
Simpson, H. D.....Vincennes
Stein, Walter.....Vincennes, 717 N. 5th St.
Teschner, W. C.....Vincennes, 1334 N. 4th St.
Toth, Mike.....Vincennes, 214 Shelby St.
Wampler, Herman B.....Bicknell, R. R. 1

Wharf, A. J.....Vincennes, R. R. 2
Yates Orchard Co., B. H.....Oaktown
Yates, N. Y.....Decker, R. R. 2
Yates, W. B.....Oaktown

LaPorte County Society

Boss, Fred.....Michigan City, R. R. 2
Dill, Fred.....LaPorte, R. R. 1
Engstrom, Geo.....LaPorte, 616 Ridge St.
Garwood, Carl.....LaPorte, R. R. 1 (Secretary)
Goldring, K. M.....LaPorte, R. R. 1
Hadaway, H. I.....South Bend, R. R. 3
Halpern, S.....LaPorte, R. R. 1, Box 485
Heberling, A.....Michigan City, R. R. 2
Kenfield, C. C.....LaPorte, 803 Fairfield Ave.
Klassen, John.....LaPorte, R. R. 1.
Kwichen, Stanley.....Chicago, Ill., 1459 N. Campbell Ave.
Luhr, A. J.....LaPorte, R. R. 2, Box 122
McDonald, Howard.....Michigan City, R. R. 3
Miller, W. M.....Michigan City, R. R. 2
Pavolka, Mike.....Michigan City, R. R. 2, Box 419
Radke, Fred.....Michigan City, R. R. 3
Shedd, Milo K.....Rolling Prairie, R. R. 1
Shreve, Robert.....Michigan City, R. R. 2, Box 309
Smith, Henry H.....LaPorte, R. R. 1, Box 21
Stanton, H. L.....LaPorte, R. R. 1
Stolze, Otto.....Michigan City, R. R. 2
Williams, John.....Three Oaks, Mich., R. R. 1
Wolf, Guy.....Westville, R. R. 1

Lawrence-Orange County Society

Burris, W. S.....Mitchell
Burton, Geo. I.....Mitchell
Gaines & Son, Luther.....Mitchell
Goss, Frank.....Paoli
Hawkins, Ernest V.....Mitchell
Hawkins, Geoffrey.....Bedford, R. R.
Heller, E. V.....Brownstown
Holden, John A.....Mitchell (Secretary)
Holmes, S. W.....Mitchell
Kelso, Victor.....Mitchell
Kendall, Herman.....Paoli, R. R. 1
Montgomery, Doyle S.....Paoli, R. R.
Moore, N. L.....Mitchell
Troth, M. S.....Orleans
Turley & Son, B. F.....Orleans

Miami County Society

Adams, B. K.....Peru, R. R. 2
Berger, L. H.....Peru, R. R. 2

Doud, Lorenzo V.....Denver
Doud, W. W.....Denver
Fisher, H. U.....Peru, R. R. 3
Kern, R. A.....Chili, R. R.
Kraning, Roger.....Peru, R. R. 3 (Secretary)
Launder & Son, C. H.....Wabash, R. R. 2
Pugh, B. J.....Mexico, R. R. 1
Tate, Arthur.....Mexico
Zook, F. W.....Denver, R. R. 1

Morgan County Society

Bradford, Albert.....Centerton
Bradford Orchards, Inc.....Martinsville, R. R. 2
Grady, Marion M.....Morgantown, R. R. 2
Hubbard, Chas. A.....Martinsville, 460 E. Washington
Hubbard, R. C.....Martinsville
Johnson, H. V.....Mooresville
Myers, T. W.....Morgantown, R. R. 2
Romine, Mrs. Margaret.....Mooresville, R. R. 5

POCKET HORTICULTURAL SOCIETY

Vanderburgh County

Bockstahler, W. J. G.....Evansville, R. R. 3
Bosse, F. H.....Evansville, 611 Jefferson Ave.
Edwards Bros.....Boonville, R. R. 2
Elmendorf, Arnold.....Evansville, 19 S.E. 4th St.
Emerson, V. R.....Cynthiana
Endress, Edmend.....Evansville, Crystal Pearl Vinegar Co.
Evansville Container Corp.....Evansville
Jaquess, F. P.....Evansville, 2813 Forest Ave. (Secretary)
Jarvis, F. H.....Evansville, 833 Adams Ave.
Kampe, Frederick.....Elberfeld
Kelsay, Dr. Clarence.....Evansville, care of Newton Kelsay Mfg. Co.
McCarty Seed Co., J. A.....Evansville, 526 N.W. 4th St.
McCutchan, Wm. C.....Inglefield
McMullen, L. C.....Evansville, 2517 W. Indiana
Miller, Walter.....Lynnville
Nunn, M. U.....Sturgis, Ky.
Odell, Frank I.....Cannelton
Raben, Chas. N.....Armstrong, R. R. 2
Ranes, Dr. J. F.....Mt. Vernon
Schnautz, Alvin.....Evansville, R. R. 4
Schneider, Edw. G.....Mt. Vernon, R. R. 4
Schwan, Louis A.....Evansville, 1010 Oakley St.
Seifert, Louis B.....Mt. Vernon, R. R. 2
Shrode, Wm. E.....Mt. Vernon
Stoever, Julius.....Evansville, 106 Adams Ave.
Trautvetter, Geo.....Boonville, R. R. 7

Wallenmeyer, John.....Evansville, 312 Madison Ave.
Waltz, John.....Evansville, 2813 Austin Ave.
Weilbrenner, Carl.....Mt. Vernon
Woods, Warren M.....Evansville, 1658 Linwood Ave.
Zutt, John H.....Evansville, R. R. 4

Washington County Society

Boggs, Frank.....Salem
Bortoff, Clem.....Salem
Bowers, Avel.....Salem, R. R. 5
Bowers, Clarence.....Salem
Cauble, Wm. A.....Salem
Colglazier, Carl M.....Salem
Colglazier, Delbert.....Salem
Colglazier, W. R.....Salem (Secretary)
Davis, Frank A.....Salem
Davis, Otis A.....Salem
Douglas, Dewey D.....Campbellsburg
Fultz, Lee.....Salem
Limp, Phillip.....Salem
Mitchell, Oscar.....Salem, R. R. 6
Nicholson, Harry.....Salem
Shultz, H. A.....Saltillo
Stevenson, Lester.....Campbellsburg, R. R.
Temple, U. V.....Pekin
Zink, Azro.....Salem, R. R. 6

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